Camera 4555

Model 1100 Wafer Dicing Saw

MAINTENANCE MANUAL

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HOW TO USE

Section 1

This manual is divided into seven sections. Section one contains the table of contents, this how to use section, a functional block diagram of systems in the 1100 saw, specifications, warnings, cautions and safety considerations. It is suggested that you read this how to use section before diving into the meat of the manual. It only takes a few minutes to read and it will give you an overview of the structure and intended usage of this manual.

Section 2

Section two provides preventive maintenance schedules and procedures for utilities (air/vacuum/water) and mechanical systems. Electrical and optical systems are passive and do not require explicit preventive maintenance procedures.

A time table for performance of various preventive maintenance tasks is given at the beginning of the preventive maintenance section (see table 1, page 2-1). Preventive maintenance should be performed whether anything is wrong with the saw or not. The importance of keeping up with the preventive maintenance schedules is exemplified by the old adage, "An ounce of prevention is worth a pound of cure."

Section 3

Section three consists entirely of maintenance tasks. Maintenance tasks involve the replacement of utility, mechanical, optical, and electronic components. A maintenance task can also be used to instruct removal of a part for access to something else.

Determination of a maintenance action can be made through observation or inspection of a defective part or by isolation of a defective part during performance of a different task. When a defective part has been identified make sure that all steps listed in the appropriate maintenance task are performed. This includes installation of a new or repaired version of the component being replaced.

Maintenance tasks can also be referenced within some other primary maintenance task that is being performed. If this is the case, the referenced maintenance task is being used for removal and installation instructions only. Do not replace the item titled in the referenced maintenance task if this is the case.

At the end of most maintenance tasks you are instructed to reverse the removal procedure. Reverse all the steps listed for the primary and referenced tasks in their order of occurrence. Perform all adjustments required by the primary and referenced tasks. Always make sure all removed parts have been installed and check the operation of the saw to see that the initial problem has been fixed.

Section 4

Section four contains adjustment tasks. Adjustment tasks can be performed on utilities, mechanics, optics and electronics. As with the maintenance and preventive maintenance

sections, steps may exist within the primary task which reference other tasks in the manual.

Determination of an adjustment action is made by reference from another task or when an adjustment is obviously required. Always check your adjustment to see that it falls within the required range and that the initial problem is solved.

Section 5

This section involves functional descriptions for all major systems of the 1100 saw. Heavy emphasis is placed on the functions of the various controlling circuit cards. By understanding the basic function of a circuit card, symptoms of faulty saw operation can be traced to the electronic components that control a particular function. Descriptions of the mechanical and utility systems should be used to provide a basic understanding of saw operation and to help in fault diagnosis as well.

Section 6

Troubleshooting consists of two kinds of tasks; fault code analysis and symptom analysis. Fault code analysis is initiated when a fault code is displayed on the program panel. Fault code analysis is specific to failure of an operation monitored by various sensors, feedback mechanisms and controlling CPUs. Symptom analysis is used when there is an observable symptom of saw malfunction by the operator. Symptom analysis is invoked when a problem arises that is not covered by any of the internal diagnostics, ie., fault codes.

Once determination of the correct troubleshooting procedure is made, follow the flow of the troubleshooting tree until a fault is discovered, ie., you are referenced to replace or adjust a component. Only follow the path that conforms to the answers given to the questions in the last step of each box.

Shops are recommended to keep a full complement of spare circuit cards on hand. It would be well advised to substitute these spare cards or interchange the compatible ones before assuming that one of the existing ones is faulty. By substituting or interchanging compatible cards, it can be determined which, if any, of the cards is in fact defective.

During initial checking of loose cables and bad connections, a faulty connection can be the result of a bad cable or a bad connector on a logic board at either end of the bad cable. Rather than go into detail over where the fault for the bad connection resides, references for replacement of the cable and both connections are listed together. It is up to you to decide which one of the group really needs to be performed.

Once a fault is found and the reference task to fix that fault is performed, always operate the saw to make sure that the problem is solved and that no new ones exist. Often times new faults are inadvertently introduced during various checks, adjustments or maintenance actions.

If at any time during performance of the task a different fault code message is displayed, perform the analy-

sis listed for that fault code.

There may be situations in which no fault code is displayed and none of the symptom troubleshooting trees lead to solution of the problem or address the problem you are experiencing. If this occurs, you may call your field service representative or use the enclosed set of schematics as a reference guide to find the problem yourself. Consult the theory of operation in section five for a functional description of the problem area.

There is no substitute for application of common sense during troubleshooting. While the troubleshooting trees were devised with thoroughness in mind, not all possibilities could always be accounted for. It is up to you to perform initial inspections of the equipment for obvious faults and take into consideration unique circumstances that may make certain faults more plausible than others.

Section 7

Section 7 contains drawings for all major assemblies of the 1100 saw. Preceding each of the mechanical assembly drawings is a parts listing of all parts illustrated in that assembly drawing. The item number shown in the parts listing is the same as the call-out number used to identify the item on the drawing. If you have a broken or defective part and do not want to order an entire new assembly, find the part on the relevant drawing, locate its item number and find the part number for that item in the parts listing. The part number is the essential information needed to order spare parts from Micro Automation.

NOTE: CIRCUIT CARDS ARE NOT DEALT WITH AS REPAIRABLE ITEMS IN THIS MANUAL. AS A RESULT, NO PARTS LISTING EXISTS FOR ITEMS ON A CIRCUIT CARD. IF A DEFECTIVE PART DOES EXIST, THE ENTIRE CARD SHOULD BE REPLACED.

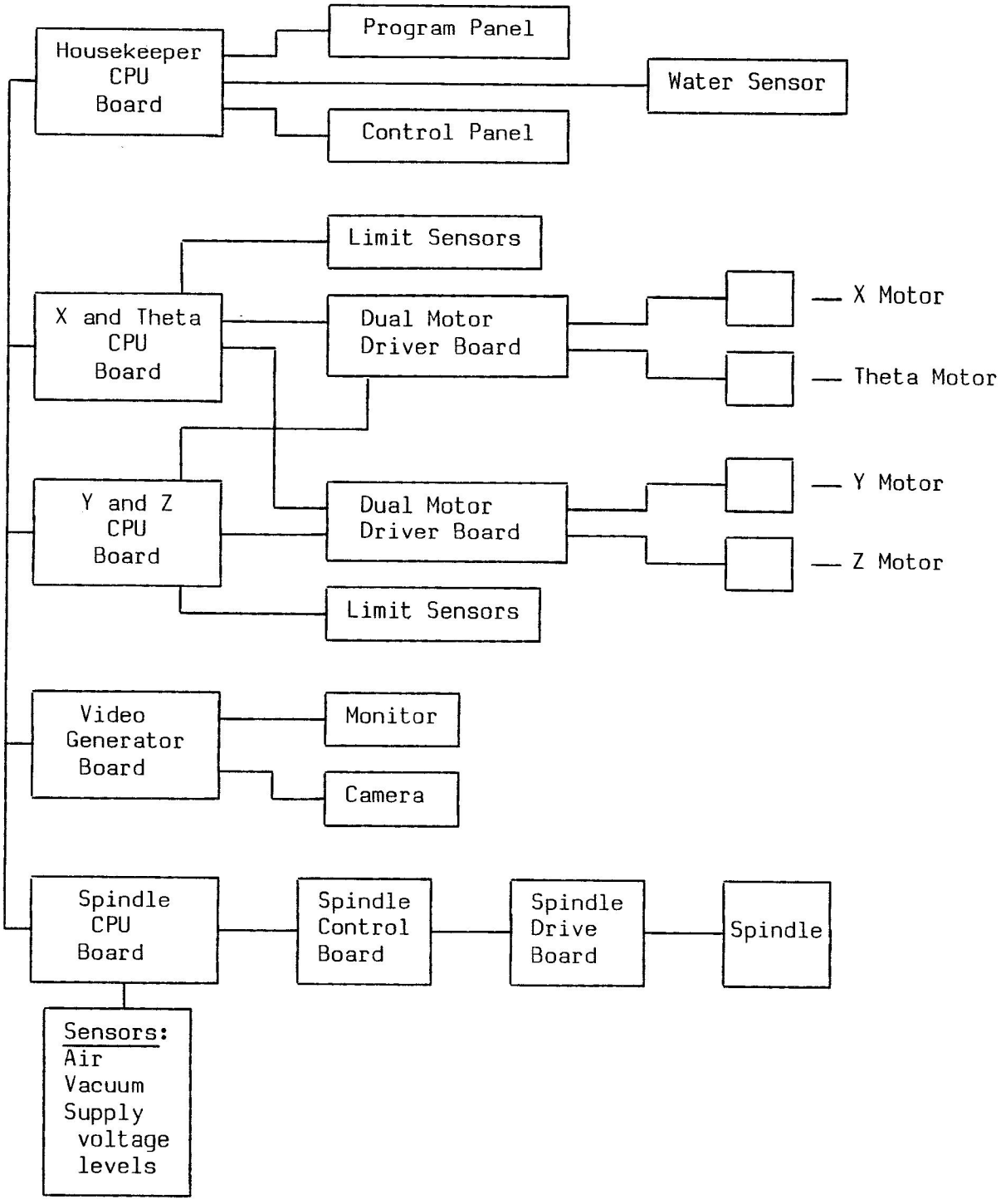


Figure 1-2: Model 1100 Saw Functional Block Diagram

1.3 SAFETY

All operators should read and understand these safety procedures before working with the system.

WARNING and CAUTION instructions must be observed during operation or servicing of the system. These instructions appear in the manual text and on labels attached to the equipment. They are defined as follows:

WARNING: Given when failure to observe its instruction can result in injury to the operator.

CAUTION: Given when failure to observe its instruction can result in permanent damage to the equipment.

NOTES: Given when failure to observe its instruction can result in improper operaton of saw.

Micro Automation Inc. cannot control the use of the equipment or be responsible for personal injury or damage resulting from its use.
Observe all **WARNINGS, CAUTIONS,** and **NOTES.** Consult local, state, and federal agencies regarding specific requirements and regulations.

1.3.1 WARNINGS

WARNING: Application of the incorrect power input voltage can cause an explosion, fire, or electrical shock that can injure the operator and damage the equipment irreparably. Ensure that the power outlet has the voltage and power ratings specified for the equipment.

WARNING: DO NOT assume that power is removed from the equipment when the power switch is off. Some portions of the circuit are HOT whenever the unit is connected to the power main. Always switch the power off and disconnect the power cable from the receptacle before removing covers exposing current carrying parts.

1.3.2 CAUTIONS

CAUTION: Use replacement fuses with the required current rating and specifications. Makeshift fuses and the short-circuiting of fuse holders may cause fire or damage to the equipment.

CAUTION: Electrical transients created by disconnecting cables or printed circuit boards can severely damage the equipment components. Always switch the power off before connecting or disconnecting any components or cables.

CAUTION: To prevent damage to the printed circuit boards, do not place a board near anything that can create an electrostatic charge and destroy components on the board. Certain components (CMOS chips) are extremely sensitive to static electricity. Before handling the boards the operator should touch a grounded metal object such as the chassis of the saw.

1.3.3 INTERLOCK

The saw is equiped with a top cover actuated safety switch. This switch disconnects all power to the saw by interrupting both the hot line and the neutral line when the cover is removed.

1.4 SPECIFICATIONS

Physical Characteristics	
Dimensions:	Length: 33" (83.8 cm) Height: 32" (81.2 cm) Depth: 30" (76.2 cm)
Weight:	330 lb (150 kg)
Weight with table:	675 lb (297 kg)
Power Requirements	
Voltage:	110/220 Vac ± 10%
Power:	Nominal: 900 W Maximum: 1500 W
Frequency:	50/60 Hz
Fuses:	2 8A, 2 2A
Air Requirement	65 PSI Minimum, 6 CFM
Vacuum Requirement	20" HG Minimum, 2 CFM
Water Requirement	
Blade Coolant:	1/2 to 1 GPM
Blade Coolant Pressure:	30 PSIG Minimum
Spindle Coolant:	6 GPH
Spindle Coolant Pressure:	30 PSIG
Drain Requirement	90 GPH
Environment	
Operating Temperature:	Nominal: 25°C
Maximum Humidity:	80% (Noncondensing)
Wafer Dimensions	
Round:	Diameter: Maximum: 6" Minimum: 2"
Rectangular:	Sides Maximum: 6"
Wafer Thickness	Maximum: 500 mils Minimum: 1 mil
Spindle Speed:	15,000 RPM to 40,000 rpm
Program Storage Capacity:	60 standard programs

LIST OF FIGURES

PREVENTIVE MAINTENANCE TIME TABLE

Every 80 hours of operation:

1) Test and lubricate Y stage assembly	See task 2.8
2) Inspect drain system	See task 2.7
3) Clean and lubricate X stage assembly	See task 2.9

Every 180 hours of operation:

1) Inspect spindle assembly	See task 2.1
2) Inspect spindle cooling system	See task 2.2
3) Inspect air system	See task 2.3
4) Inspect and test vacuum system	See task 2.5
5) Test cutting water system	See task 2.6
6) Clean and lubricate Z stage assembly	See task 2.10
7) Clean and lubricate theta stage assembly	See task 2.11
8) Clean and lubricate vacuum chuck assembly	See task 2.4
9) Lubricate X drive pin	See task 2.9

Every 1000 hours of operation:

1) Clean solenoids	See task 3.2

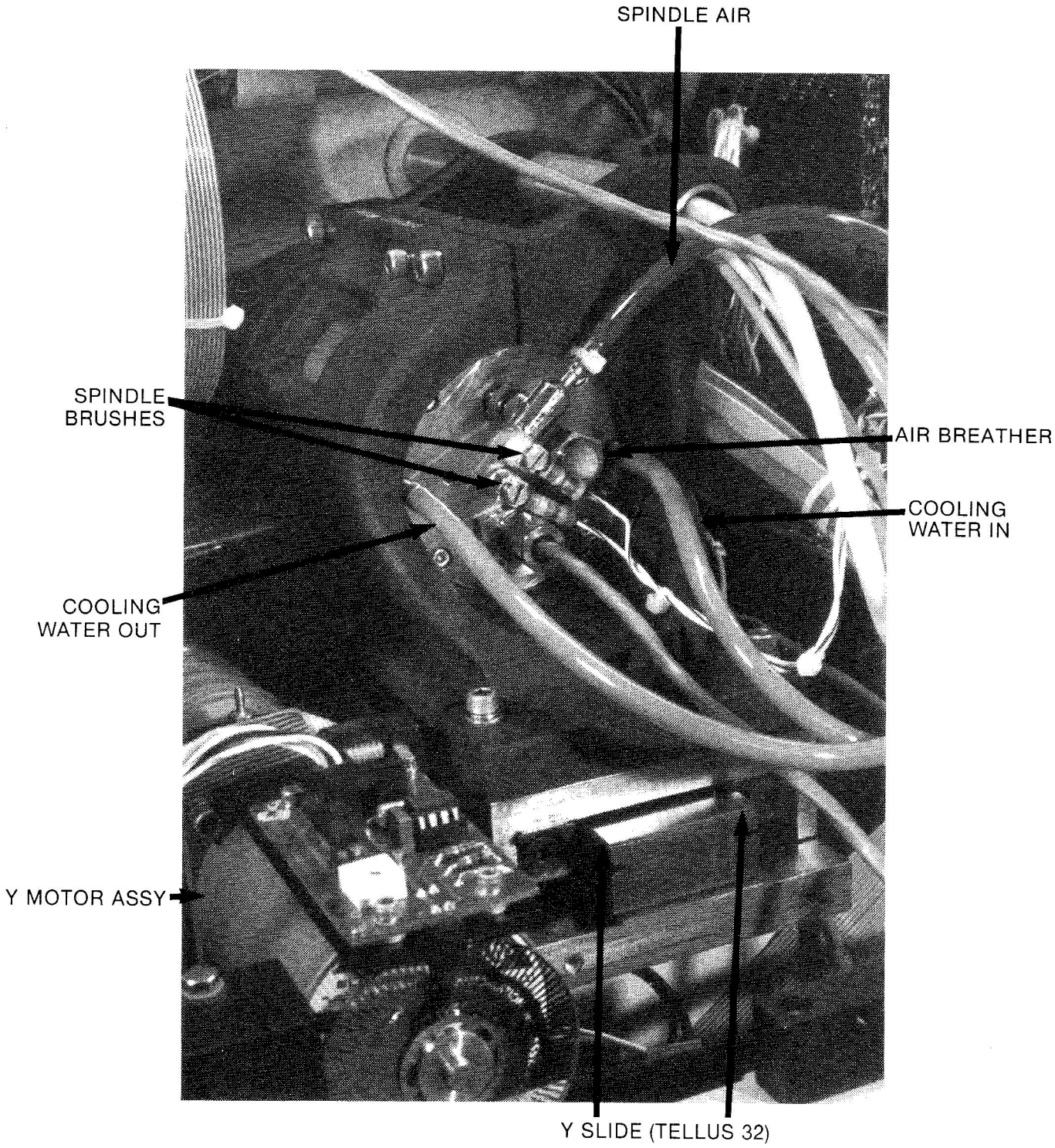


FIGURE 1
REAR OF Y-SLIDE ASSY

SECTION 2 (Preventive Maintenance)

2.1 SPINDLE ASSEMBLY
See figure 1

Inspection:

1) Remove front nozzle housing and inspect for slurry or foreign materials on spindle output shaft. Inspect for slurry, moisture and dirt on front of spindle motor housing where it joins casting. If needed, clean spindle (see below).

2) Remove brush mounting screws from rear of spindle motor (see task 3.76). Inspect brushes for damage or signs of wear. If needed, replace brushes. Extend brush springs to compensate for wear.

3) Inspect spindle coolant and air tubes for leaking, looseness, damage or wear. Replace if necessary (see task 3.7).

Cleaning:

CAUTION: MAKE SURE POSITIVE AIR PRESSURE IS ON DURING ALL CLEANING OPERATIONS NEAR SPINDLE OUTPUT SHAFT.

1) Remove saw blade (see operator manual).

2) Clean accumulations with water and mild detergent.

3) If accumulation causes friction between spindle shaft and shaft housing, remove rear nozzle housing (see task 3.11).

4) Clean accumulations with water and mild detergent.

5) Install rear nozzle housing and saw blade (see task 3.11, see operator manual).

6) If required, adjust tangential spray nozzle (see task 4.10).

7) If required, align rear nozzle housing position (see task 4.11).

8) Install front nozzle housing.

To clean front of spindle housing where it joins casting, proceed as follows:

CAUTION: DURING THE FOLLOWING MAINTENANCE AND CLEANING OPERATIONS, DO NOT DAMAGE OR WET MYLAR INSULATOR BETWEEN SPINDLE HOUSING AND SPINDLE CASTING. CONTINUITY BETWEEN CASTING AND SPINDLE HOUSING WILL CAUSE FAILURE OF CHUCK ZERO CIRCUIT.

1) Using a brush, clean away accumulations from spindle housing where it joins casting.

2) Using a dry cloth or wiping tissue, wipe remaining accumulation away.

3) Using compressed air or inert gas, blow-dry entire area thoroughly.

2.2 SPINDLE COOLING SYSTEM
See figure 1

Inspection and Testing:

1) Run WATER TEST for cutting water (see operator manual).

2) Inspect the following coolant lines for leaks, damage or wear:

   a) Green tube from elbow tube to spindle.

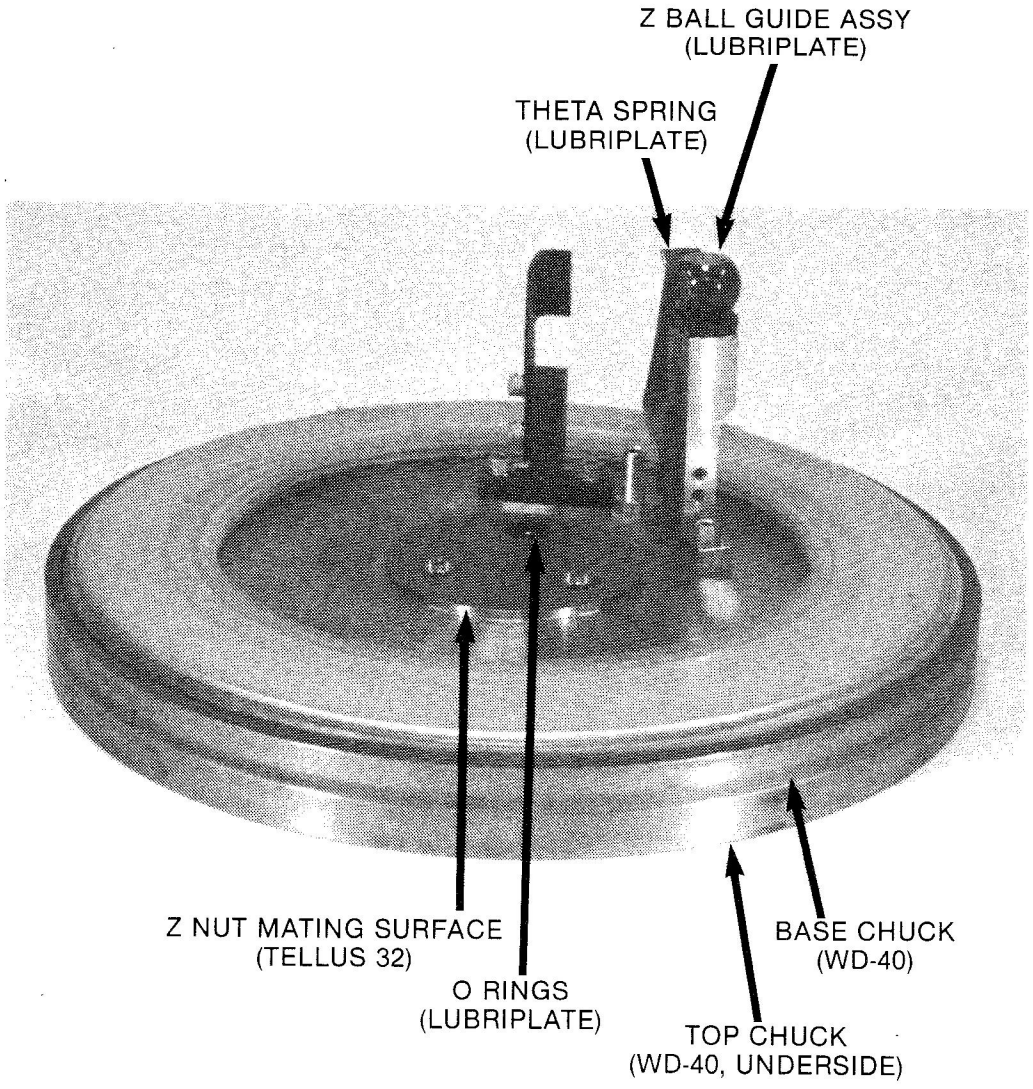


FIGURE 2
VACUUM CHUCK ASSY

b) Green tube from spindle to bulkhead fitting.

3) If coolant lines are defective, replace them (see task 3.7).

4) Every 1000 hours of operation clean solenoid #6 (see task 3.2).

2.3 AIR SYSTEM
See figure 5

Inspection and Testing.

1) Turn saw power ON.

2) Inspect the following air lines for leaks, damage or wear:

a) Blue main air supply tube from air/vacuum manifold to connector on fitting.
b) Red spindle blow-out tube from solenoid #5 on air/vacuum manifold to cooling water connector fitting.
c) Green cooling water in tube from elbow fitting to spindle.
d) Red air lift-off tube from air/vacuum manifold to air regulator.
e) Red air lift-off tube from air regulator to vacuum chuck.
f) Orange air purge tube from valve #1 on air/vacuum manifold to Y leadscrew.
g) Orange air purge tube from valve #1 on air/vacuum manifold to optics body.
h) Violet tube from barb fitting to air pressure sensor on motherboard.
i) Blue tube from barb fitting to spindle.
j) Yellow blow-off tube from valve #2 on air/vacuum manifold to optics body.

3) If air tubes are defective, replace them (see task 3.7).

4) Perform the following steps to check the spindle air pressure sensor:

a) Program saw in mode 817 (see operator manual).
b) Read spindle air pressure on display and on service unit air pressure gauge.
c) If discrepancy is 7 PSI or more, replace micron air filter (see task 3.6).
d) If discrepancy is greater than 5 PSI, adjust spindle air pressure sensor (see task 4.8).

2.4 VACUUM CHUCK
See figure 2

NOTE: PERFORM PREVENTIVE MAINTENANCE FOR VACUUM CHUCK AND Z-STAGE TOGETHER TO AVOID REMOVING THE VACUUM CHUCK MORE OFTEN THAN NECESSARY.

Cleaning:

NOTE: ALWAYS KEEP THE VACUUM CHUCK SURFACE, CONCENTRIC VACUUM GROOVES AND HOLE CLEAN OF FOREIGN MATERIAL. FOR DIFFICULT PLUGGING, APPLY AIR PRESSURE TO VACUUM LINE FITTING.

1) Remove vacuum chuck assembly (see task 3.12).

CAUTION: THESE SURFACES MUST BE CLEAN AND FREE FROM DENTS, SCRATCHES OR ANY IMPERFECTION. THE CLEANLINESS AND FLATNESS OF THIS SURFACE WILL DIRECTLY EFFECT THE CHUCK LEVEL.

2) Clean under surface of top chuck and both surfaces of base chuck with WD-40.

3) If under surface of base chuck is corroded and normal cleaning fails to remove corrosion, wrap #600 emery paper (lightly oiled) over a flat object (such as the pressure washer for the blade mounting) and carefully polish the area in a figure 8 motion.

Lubrication:

NOTE: ALWAYS LUBRICATE VACUUM CHUCK ASSEMBLY BEFORE REINSTALLING

1) If required, remove vacuum chuck assembly (see task 3.12).

2) Apply a thin coat of Lubriplate to O rings and bottom of base chuck.

3) Clean Z ball guide and theta spring with WD-40 and grease with Lubriplate.

4) Install vacuum chuck assembly (see task 3.12).

5) Perform chuck flatness adjustment (see task 4.21).

2.5 VACUUM SYSTEM

Inspection and Testing:

1) Inspect the following vacuum tubes for damage or wear:

   a) Green tube from solenoid #2 on air/vacuum manifold to blade removal tool.
   b) Vinyl tube from solenoid #1 on air/vacuum manifold to vacuum chuck.
   c) Natural colored main vacuum supply tube from air/vacuum manifold to bulkhead fitting.
   d) Violet tube from solenoid #1 on air/vacuum manifold to vacuum sensor on motherboard.

2) If damage exists replace bad tubing (see task 3.7).

3) Check for vacuum tube leakage as follows:

   a) Program saw for mode 817 (see operator manual).
   b) Place a film frame over vacuum chuck and press WAFER LOCK.
   c) If vacuum pressure indicated on program panel display drops more than 3 Hg., a vacuum tube is leaking.
   d) Replace leaking tube (see task 3.7).

4) Inspect face of blade removal tool.

5) If blade removal tool is dirty, scratched or dented, clean it (see below).

   NOTE: VACUUM TO CHUCK AND BLADE REMOVAL TOOL SHOULD BE OFF WHILE PERFORMING STEP 6. TEST IS INVALID IF VACUUM TUBES LEAK.

6) Perform the following steps to test the vacuum sensor:

   a) Program saw for mode 817 (see operator manual).
   b) Read vacuum on display and on service unit vacuum gauge.
   c) If discrepancy is 2 or more Hg., adjust vacuum sensor (see task 4.9).

Cleaning:

1) Clean blade removal tool by placing face down on #600 grade abrasive

paper (lightly oiled) on a flat surface and carefully polish until all dents and scratches are removed.

2.6 CUTTING WATER SYSTEM
See figure 9

NOTE: BEFORE TESTING THE CUTTING WATER SYSTEM, SET THE SERVICE UNIT TO 25 PSI WATER PRESSURE AND 30-50 GPH WATER FLOW.

Testing:

1) Perform WATER TEST function (see operator manual).

2) Inspect the following water tubes for leaks, damage or wear:

   a) Orange tube from tee fitting to front nozzle housing.
   b) Yellow tube from tee fitting to rear nozzle housing.
   c) Violet tube from additive injector barb fitting to barb fitting.

3) If water tubes are defective, replace them (see task 3.7).

4) Remove front nozzle housing and place finger over fitting where water will come out (see task 3.10).

5) Perform WATER TEST function.

6) Inspect water coming out of tangential spray nozzle and blade spray nozzle.

7) If a smooth stream does not come out of 4 holes in rear nozzle housing plate and two holes in tangential spray nozzle, clean rear nozzle housing (see below).

8) Install front nozzle housing.

9) Perform WATER TEST function.

10) If a smooth stream does not come out of 5 holes in front nozzle housing plate, clean front nozzle housing (see below).

Cleaning:

To clean the front and rear nozzle housings:

1) Remove front nozzle housing (see task 3.10).

2) Clean holes in nozzle plates and spray nozzle with fine wire (.020 inch).

3) Install front nozzle housing.

2.7 DRAIN SYSTEM

Inspection and Cleaning:

1) Inspect drain system for obstructed flow.

2) If required, remove and clean strainer.

3) If required, use a flexible wire or air pressure to clear obstructing materials.

2.8 Y-STAGE ASSEMBLY
See figures 1, 12

Testing:

1) Check Y stage repeatability (see task 4.16).

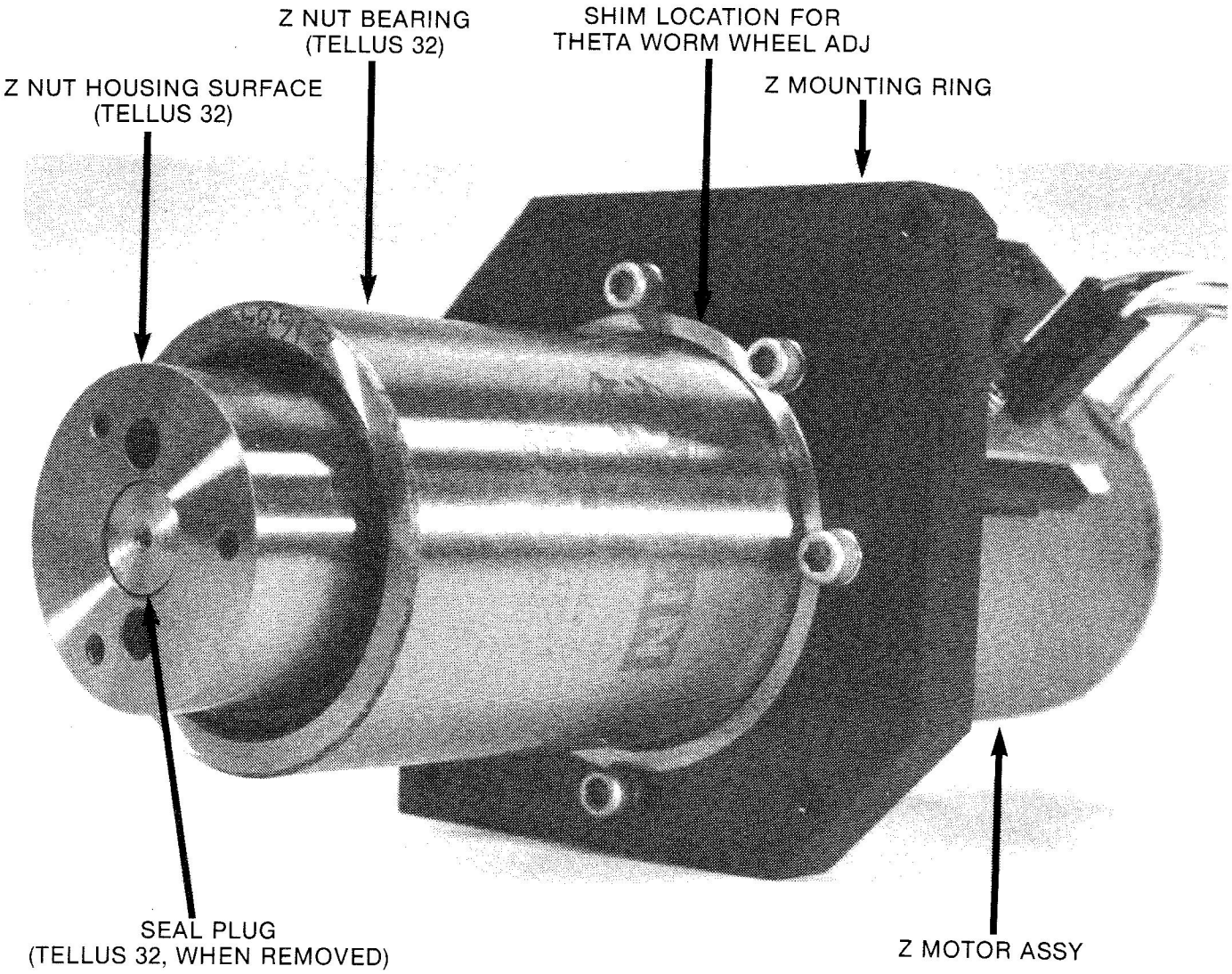


FIGURE 3
Z DRIVE ASSY

Cleaning and lubrication:

1) Lubricate Y slide with one drop of shell tellus 32 on each side of Y slide runner on each end of Y slide assembly.

2) Remove two screws and ball holder from Y slide flag holder.

3) Compress Y leadscrew finger and remove ball holder from DBL nut.

4) Place 3 drops of shell tellus 32 oil into ball shaft bushing.

5) Grease tooling ball and Y leadscrew finger with Lubriplate.

6) Install ball holder on DBL nut.

7) Install ball holder and two screws on Y slide flag holder.

2.9 X-STAGE ASSEMBLY
See figure 10

Cleaning:

1) Remove front tray (see task 3.9).

2) Clean all machined surfaces with WD-40 and wipe up any excess oil.

3) Lubricate X stage (see below).

Lubrication:

1) Remove X-drive pin and grease O ring with lubriplate.

2) Remove plug screw from top of right pillow block and oil pillow block with 3 drops of shell tellus 32.

3) Install plug screw.

NOTE: Left pillow block will be oiled when theta worm wheel assembly is removed for routine maintenance.

3) Oil X-stage guide rail with shell tellus 32.

4) Grease X-leadscrew with Lubriplate.

5) Install front tray (see task 3.9).

6) Perform chuck flatness adjustment (see task 4.21).

2.10 Z-STAGE ASSEMBLY
See figure 3

NOTE: PERFORM PREVENTIVE MAINTENANCE FOR VACUUM CHUCK AND Z-STAGE TOGETHER TO AVOID REMOVING THE VACUUM CHUCK MORE OFTEN THAN NECESSARY.

Cleaning:

1) Remove vacuum chuck assembly (see task 3.12).

2) Remove oil ring cap and felt oil ring washer.

3) Clean top of Z-nut housing with WD -40.

4) Insert screw into threaded plug and pull up to remove Z bearing seal plug.

5) Place a couple drops of shell tellus 32 oil into Z nut.

6) Install Z bearing seal plug.

7) Install felt oil ring washer on Z nut.

8) Oil felt oil ring washer with shell tellus 32 to saturation.

9) Install oil ring cap on Z nut.

10) Coat mating surface of Z nut housing and underside of base chuck with shell tellus 32.

11) Install vacuum chuck assembly.

12) Perform chuck flatness adjustment (see task 4.21).

2.11 THETA ASSEMBLY
See figure 11

Cleaning and lubrication:

1) Remove vacuum chuck assembly (see task 3.12).

2) Remove theta worm wheel assembly (see task 3.35).

3) Remove theta worm drive w/motor assembly (see task 3.34).

4) Remove four screws, washers theta worm cover and grease clip from support.

5) Using WD-40 and brush, thoroughly clean old grease from theta worm gear and theta worm wheel.

6) Grease worm gear and worm wheel teeth by "palming" with Lubriplate.

7) Grease grease clip with Lubriplate.

8) Remove left pillow block plug screw.

9) Oil left pillow block with 4 drops of shell tellus 32.

10) Install left pillow block plug screw.

11) Install theta worm cover, four washers, screws and grease clip to theta worm drive support.

12) Install theta worm drive assembly.

13) Install theta worm wheel assembly.

14) Adjust theta worm wheel (see task 4.19).

15) Adjust theta worm drive (see task 4.20).

16) Install front tray.

17) Install X splash guard.

18) Install vacuum chuck assembly (see task 3.12).

19) Perform chuck flatness adjustment (see task 4.21).

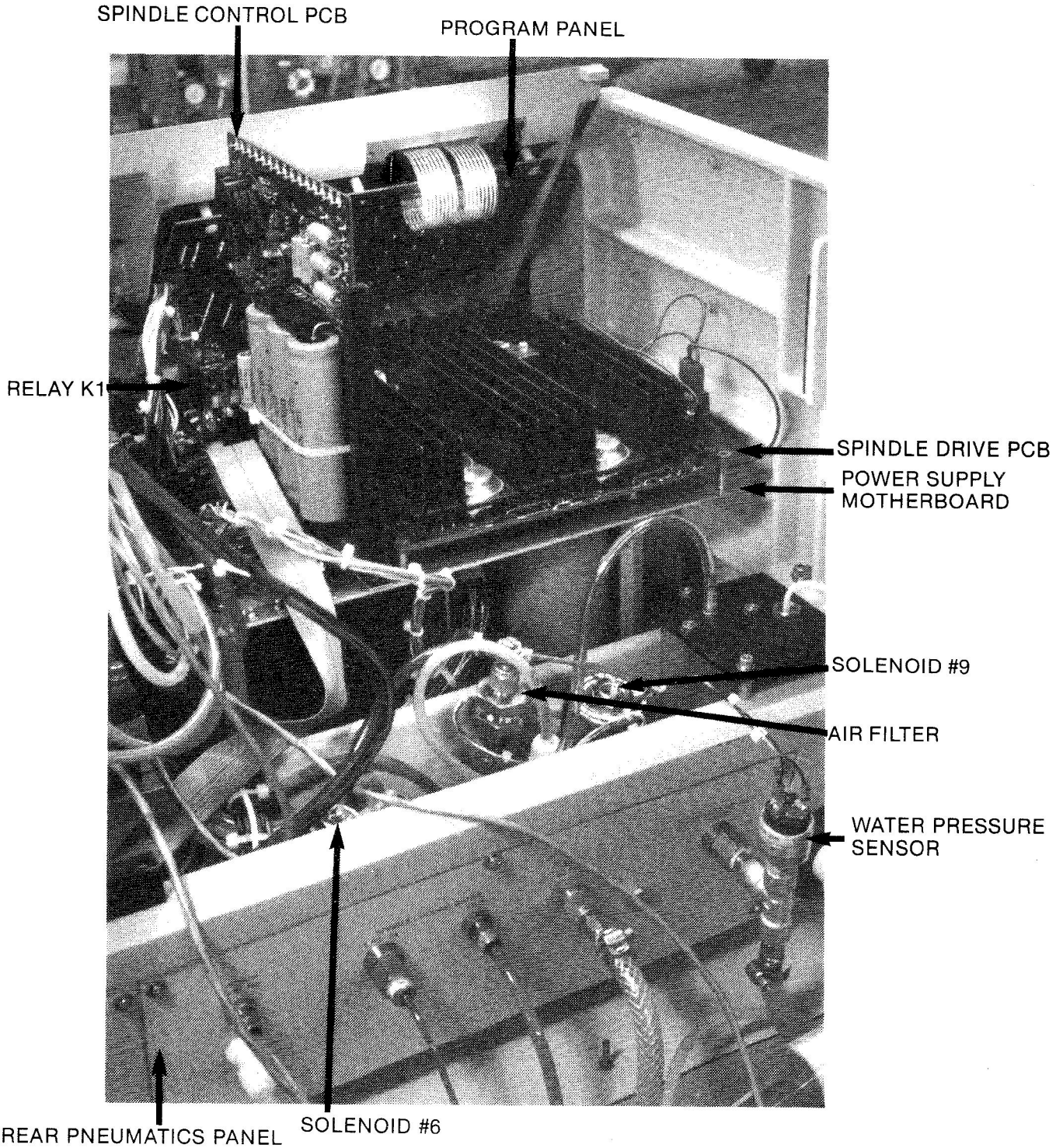


FIGURE 4
RIGHT REAR OF SAW

SECTION 3 (MAINTENANCE)

UTILITIES

3.1 REPLACE AIR REGULATOR:
Part #31516130-001

1) Push saw power OFF.

2) Lift top cover.

3) Remove two tubes from rear of air regulator.

4) Remove set screw and knob from front of air regulator.

5) Remove jam nut and air regulator from control panel.

6) Reverse procedure to install air regulator.

7) Check function of air regulator (see operator manual).

3.2 CLEAN SOLENOIDS:

NOTE: BEFORE REPLACING A SOLENOID SUSPECTED OF BEING DEFECTIVE, YOU MAY WANT TO CLEAN SOLENOID OF CONTAMINATING PARTICLES. ALL SOLENOIDS ARE CLEANED THE SAME WAY.

1) Remove solenoid (see tasks 3.3-3.5).

2) Remove nut, plate, body and washer from shaft.

3) Remove shaft, plunger, spring and seal from solenoid.

4) Using pressurized air, clean solenoid of contaminants.

5) Clean plunger, spring and shaft, checking for free, smooth clearance when plunger is manually pressed into shaft.

6) Reverse procedure to assemble and install solenoid.

7) Check function controlled by solenoid.

3.3 REPLACE AIR/VACUUM MANIFOLD SOLENOIDS 1-5:
Part #43521730-001
See page 7-14

1) Push saw power OFF.

2) Lift top cover.

3) Remove two leads from solenoid.

4) Remove two screws from back of manifold and remove solenoid.

5) Reverse procedure to install new solenoid.

6) Operate system involved with solenoid (see operator manual).

7) Check for leaking tubes or fittings.

3.4 REPLACE SOLENOID #6
Part #43514890-001
See page 7-18, figure 4

1) Push saw power OFF.

2) Lift top cover.

3) Remove two wire leads from solenoid.

4) Remove green tube from elbow on street T.

5) Unscrew check valve from other end of street T.

6) Unscrew street T from solenoid.

7) Unscrew solenoid from bulkhead adapter.

NOTE: ALL THREADED CONNECTIONS NEED TO BE SEALED WITH PIPE SEALANT.

8) Reverse procedure to install new solenoid.

9) Run system to check for spindle cooling and spindle air blowout (see operator manual).

10) Check for leaking tubes or fittings.

3.5 REPLACE SOLENOID #9
Part #43522630-001
See page 7-18, figure 4

1) Push saw power OFF.

2) Lift top cover.

3) Unscrew yellow and orange tubes from street T.

4) Remove barb fitting with violet tube from street T.

5) Remove pressure sensor from street T.

6) Unscrew solenoid, T and street L by turning adapter.

7) Remove street L and T from solenoid.

NOTE: ALL THREADED CONNECTIONS NEED TO BE SEALED WITH PIPE SEALANT.

8) Reverse procedure to install new solenoid.

9) Run system to check for cutting water (see operator manual).

10) Check for leaking tubes or fittings.

3.6 REPLACE MICRON AIR FILTER
Part #31513610-001
See page 7-18, figure 4

1) Lift top cover.

2) Remove T with spindle air tube from nut.

3) Remove nut and two ferrules from filter.

4) Remove filter from connector.

NOTE: USE PIPE SEALANT ON ALL THREADED CONNECTIONS, AS REQUIRED.

5) Install new filter on connector.

6) Install modified plug on filter.

7) Install T with spindle air tube on modified plug.

8) Check function of air system (see operator manual).

9) Adjust air pressure sensor (see task 4.8).

3.7 REPLACE TUBING:
Use drawing #18031290-001
See page 7-14

Always replace tubing with tubing of the same color, diameter and bore.

NOTE: THERE ARE TWO BASIC TYPES OF TUBE CONNECTIONS; BARBED FITTINGS AND CONNECTOR FITTINGS.

To replace tube with barbed fitting:

1) If tube cannot be easily pulled from barbed fitting, cut tube at end of barb and remove remaining portion of tube with screwdriver and needle nose pliers.

2) Install new tube by fitting tube over barb.

To replace tube with connector fitting:

1) Unscrew connector and remove tube.

2) Install new tube in connector and screw on connector.

3.8 REPLACE PNEUMATIC FITTING
Use drawing #11024030-001
See page 7-18

1) Unscrew fitting from fitting.

NOTE: ALL THREADED CONNECTIONS NEED TO BE SEALED WITH PIPE SEALANT.

2) Screw fitting on fitting.

MECHANICAL

3.9 REPLACE FRONT TRAY
Part #13023100-110
See page 7-9

1) Remove vacuum chuck assembly (see task 3.12).

2) Remove three screws and X splash guard from X splash guard support.

3) Remove four screws and front tray from tray support plate and tray support.

4) Reverse procedure to install front tray.

5) Perform chuck flatness adjustment (see task 4.21).

3.10 REPLACE FRONT NOZZLE HOUSING ASSEMBLY
Part #12025660-001
See page 7-10

1) Push saw power OFF.

2) Remove panel screw and front nozzle assembly from rear nozzle assembly.

3) Reverse procedure to install front nozzle assembly.

4) Check for proper cutting water (see task 2.6).

3.11 REPLACE REAR NOZZLE HOUSING ASSEMBLY
Part #12025670-001
See page 7-10

1) Push saw power OFF.

2) Remove front nozzle housing assembly (see task 3.10).

3) Remove saw blade (see operator manual).

4) Remove two tubes from barbed fittings.

5) Remove two screws, washers and housing assembly from spindle plate.

6) Reverse steps 2-4 to install rear housing assembly.

7) Adjust rear nozzle housing assembly (see task 4.11).

8) Install front nozzle housing assembly (see task 3.10).

3.12 REPLACE VACUUM CHUCK ASSEMBLY
Part #11026190-001
See page 7-10

1) Push saw power OFF.

2) Screw top chuck off base chuck.

3) Remove three screws from base chuck.

CAUTION: DO NOT DAMAGE Z SENSOR OR Z FLAG WHEN REMOVING CHUCK ASSEMBLY.

4) Remove tube from barb while removing vacuum chuck assembly from Z-bearing assembly.

5) Clean and lubricate vacuum chuck assembly (see task 2.4).

6) Reverse procedure to install vacuum chuck assembly.

7) Perform chuck flatness adjustment on top chuck (see task 4.21).

3.13 REPLACE VACUUM CHUCK ASSEMBLY BELLOWS
Part #12009570-001
See page 7-20

1) Remove vacuum chuck assembly (see task 3.12).

2) Remove six screws and bellows from base chuck.

3) Reverse procedure to install bellows.

4) Perform chuck flatness adjustment (see task 4.21).

3.14 REPLACE Z FLAG MOUNT
Part #13001240-001
See page 7-20

1) Remove vacuum chuck assembly (see task 3.12).

2) Remove two screws, washers and Z flag mount from base chuck.

3) Reverse procedure to install Z flag mount.

4) Perform chuck flatness adjustment (see task 4.21).

3.15 REPLACE Z FLAG
Part #13031230-001
See page 7-20

1) Remove vacuum chuck assembly (see task 3.12).

2) Remove two screws, washers and Z flag from Z flag mount.

3) Reverse procedure to install Z flag.

4) Perform chuck flatness adjustment (see task 4.21).

3.16 REPLACE Z BALL GUIDE ASSEMBLY
Part #12002640-001
See page 7-20

1) Remove vacuum chuck assembly (see task 3.12).

2) Remove two screws, washers and Z ball guide assembly from base chuck.

3) Grease Z ball guide and theta spring with Lubriplate.

4) Reverse procedure to install Z ball guide assembly.

5) Perform chuck flatness adjustment (see task 4.21).

3.17 REPLACE THETA SPRING
Part #13022650-001
See page 7-20

1) Remove vacuum chuck assembly (see task 3.12).

2) Remove screw washer and theta spring from Z ball guide assembly.

3) Grease theta spring with Lubriplate.

4) Reverse procedure to install theta spring.

5) Perform chuck flatness adjustment (see task 4.21).

3.18 REPLACE VACUUM CHUCK ASSEMBLY O RINGS
Part #30507330-001
See page 7-20

1) Remove vacuum chuck assembly (see task 3.12).

2) Remove three O rings from bottom of base chuck.

3) Grease O rings with Lubriplate.

4) Reverse procedure to install three O rings.

5) Perform chuck flatness adjustment (see task 4.21).

3.19 REPLACE VACUUM CHUCK ASSEMBLY BARBED FITTING
Part #30512760-001
See page 7-20

1) Remove vacuum chuck assembly (see task 3.12).

2) Remove barbed fitting and washer from base chuck.

3) Reverse procedure to install barbed fitting.

4) Perform chuck flatness adjustment (see task 4.21).

3.20 REPLACE Y LEADSCREW
Part #11023980-001
See page 7-6

1) Push saw power OFF.

2) Lift top cover.

3) Remove ribbon cable connector from PCB on motor.

4) Remove two screws, splitlock washers and flat washers from ball holder.

5) Compress Y leadscrew finger and remove ball holder from Y leadscrew DBL nut.

6) Remove two screws, splitlock washers and washers from support.

CAUTION: DO NOT DAMAGE ENCODER DISK WHILE REMOVING Y LEADSCREW ASSEMBLY.

7) Remove Y leadscrew from front support block and base casting.

8) Remove two screws, splitlock washers, washers and front support block from base casting.

9) Reverse procedure to install Y leadscrew assembly.

10) Perform Y leadscrew adjustment (see task 4.16).

3.21 REPLACE SAW X RAIL ASSEMBLY
Part #12017060-001
See page 7-23

1) Remove X stage assembly (see task 3.27).

2) Remove X rail from X stage assembly.

3) Scrape old grout off base casting mounting pads and, if required, old X rail.

4) Apply RC601 grout around perimeter of base casting mounting pads.

5) Lightly oil underside of X rail with shell tellus 32.

6) Remove eight screws, washers and two pillow blocks from X stage.

7) Slide pillow blocks on X rail.

8) Set X rail on top of grouted mounting pads.

9) Adjust pillow block set screw to where pillow block just begins to tighten when rotated on X rail.

10) Insert four washers and screws through mounting holes to align X rail.

11) Push X rail to the rear and let sit overnight so grout will harden.

12) Tighten four screws and X rail to base casting.

13) Install X stage, eight washers, and screws to two pillow blocks.

14) Insert X drive pin in DBL supernut.

15) Install front tray (see task 3.9).

16) Perform chuck flatness adjustment (see task 4.21).

17) Oil X rail with shell tellus 32.

3.22 REPLACE SPINDLE W/CONNECTOR ASSEMBLY
Part # 12031240
See page 7-31

1) Remove rear nozzle housing assembly (see task 3.11).

2) Remove nut and blade spacer from spindle shaft.

3) Loosen screw securing spindle housing to spindle plate.

4) Loosen four screws on spindle mount and remove spindle with spindle insulator from spindle mount.

CAUTION: DO NOT DAMAGE SPINDLE INSULATOR WHILE INSTALLING SPINDLE OR FAILURE OF CHUCK ZERO CIRCUIT WILL RESULT.

NOTE: SPINDLE INSULATOR SHOULD COMPLETELY INSULATE SPINDLE FROM SPINDLE MOUNT.

5) Reverse procedure to install spindle.

6) Perform spindle perpendicularity adjustment (see task 4.22).

3.23 REPLACE Y SLIDE
Part #33522940-001
See page 7-31

1) Remove spindle w/connector assembly (see task 3.22).

2) Remove camera assembly (see task 3.52).

3) Remove two screws, splitlock washers and washers from front of spindle support.

4) Remove two screws, splitlock washers,washers and spindle support from Y slide.

5) Remove Y slide flag holder (see task 3.25).

6) Remove six screws, washers and PCB assembly from Y slide.

7) Remove four screws, washers and Y slide from base casting.

8) Scrape old grout off base casting mounting pads and, if required, old Y slide.

9) Apply RC601 grout around perimeter of base casting mounting pads.

10) Lightly oil underside of Y slide with shell tellus 32.

11) Set Y slide on top of grouted mounting pads.

12) Insert four washers and screws through mounting holes to align Y slide.

13) Push Y slide to the left and let sit overnight so grout will harden.

14) Tighten four screws and Y slide to base casting.

15) Reverse procedure to install Y slide.

16) Perform spindle perpendicularity and Y alignment adjustments (see tasks 4.16-4.18, 4.22).

3.24 REPLACE Y LIMIT SENSOR PCB ASSEMBLY
Part #12004470-001
See page 7-31

1) Remove Y leadscrew (see task 3.20).

CAUTION: DO NOT DAMAGE Y FLAG OR Y LIMIT SENSOR WHILE REMOVING PCB ASSEMBLY.

2) Remove 6 screws, washers and PCB assembly from Y slide.

3) Reverse procedure to install PCB assembly.

4) Perform Y flag adjustment (see task 4.17).

3.25 REPLACE Y SLIDE FLAG HOLDER
Part #13023440-001
See page 7-31

1) Remove two screws and washers securing ball holder to Y slide flag holder.

2) Remove two screws, splitlock washers, washers and flag holder from Y slide.

3) Reverse procedure to install flag holder.

4) Perform Y flag adjustment (see task 4.17).

3.26 REPLACE Y FLAG
Part #13024230-001
See page 7-31

1) Remove Y slide flag holder (see task 3.25).

2) Remove two screws and Y flag from flag holder.

3) Reverse procedure to install Y flag.

4) Perform Y flag adjustment (see task 4.17).

3.27 REPLACE X STAGE ASSEMBLY
Part #11024010-001
See page 7-7

1) Push saw power OFF.

2) Remove front tray (see task 3.9).

3) Remove four screws and washers from saw X rail.

4) Lift X drive pin out of DBL supernut and remove X stage from under tray support and away from base casting.

5) Reverse procedure to install X stage.

6) Perform X stage adjustment (see task 4.15).

7) Perform chuck flatness adjustment (see task 4.21).

3.28 REPLACE ROLLER SUPPORT PLATE
Part #13029130-001
See page 7-7

1) Remove X stage assembly (see task 3.27)

2) Remove screw and washer from right side of support plate.

3) Remove screw and jack screw from left side of support plate.

4) Remove support plate from base casting.

5) Reverse procedure to install support plate.

6) Perform chuck flatness adjustment (see task 4.21).

3.29 REPLACE LEFT AND/OR RIGHT X STAGE PILLOW BLOCK ASSEMBLY
Part #12018220-001
See page 7-23

1) Remove front tray (see task 3.9).

2) Remove theta worm drive w/motor assembly (see task 3.34).

NOTE: STEP 3 WILL ENABLE THE X STAGE MOUNTING PLATE TO BE LIFTED UP FOR REMOVAL OF PILLOW BLOCK.

3) Loosen four screws from pillow block not being removed.

4) Remove four screws and washers from pillow block being removed.

5) Lift X stage up at end where pillow block is being removed and slide pillow block off X rail.

6) Liberally oil new pillow block with shell tellus 32.

7) Slide new pillow block on X rail.

8) Adjust set screw to where pillow block just begins to tighten when rotated on X rail.

9) Lift X stage up and slide pillow block under mounting plate.

10) Install pillow block, four washers and screws on mounting plate.

11) Tighten four screws on other pillow block.

12) Install theta worm wheel w/motor assembly.

13) Install front tray (see task 3.9).

14) Perform chuck flatness adjustment (see task 4.21).

3.30 REPLACE LEVELING ROLLER SUPPORT ASSEMBLY
Part #12005850-001
See page 7-23

1) Remove front tray (see task 3.9).

2) Remove screw, washer, and jackscrew from right side of roller support.

3) Remove screw and washer from left side of roller support.

4) Tilt X stage up and remove roller support from X stage.

5) Apply Lubriplate to felt wipers outward from roller support shaft bearing.

6) Reverse procedure to install roller

support.

7) Perform chuck flatness adjustment (see task 4.21).

3.31 REPLACE X DRIVE PIN W/GROOVE MOUNT
Part #13029340-001
See page 7-23

1) Remove three screws, washers and front access panel from base casting.

2) Remove two screws, splitlock washers and washers from X drive pin.

3) Lift X drive pin from X leadscrew DBL supernut.

4) Remove O ring from X drive pin.

5) Apply Lubriplate to O ring of X drive pin.

6) Reverse procedure to install X drive pin.

3.32 REPLACE POWERED SPRING
Part #32501030-001
See page 7-23

1) Remove front tray (see task 3.9).

2) Place paper clip through loop in end of powered spring cable, remove cable from cable retainer and slowly release cable into powered spring housing.

3) Remove screw, mounting bar and nut from powered spring.

4) Remove screw and washer from theta spring spacer.

5) Remove powered spring from spring reel bracket and theta spring spacer.

6) Reverse procedure to install powered spring.

7) Perform chuck flatness adjustment (see task 4.21).

3.33 REPLACE THETA LIMIT SENSOR PCB
Part #12004492-001
See page 7-23

1) Remove front tray (see task 3.9).

2) Remove ribbon cable connector from PCB.

CAUTION: DO NOT DAMAGE THETA FLAG OR THETA SENSOR WHILE REMOVING PCB.

3) Remove three screws, washers, spacers and PCB from mounting plate.

4) Reverse procedure to install PCB.

5) Perform chuck flatness adjustment (see task 4.21).

3.34 REPLACE THETA WORM DRIVE W/MOTOR ASSEMBLY
Part #12015820-001
See page 7-23

1) Remove front tray (see task 3.9).

2) Remove ribbon cable connector from theta motor assembly.

3) Remove two screws, splitlock washers and washers from support.

4) Remove screw and washer from support.

5) Remove screw and washer from cable clamp.

CAUTION: DO NOT DAMAGE ENCODER DISK WHILE REMOVING THETA WORM DRIVE

6) Remove theta worm drive off theta worm wheel and lift away from base casting.

7) Install theta support, two splitlock washers and washers to base casting.

8) Install washer and screw to support and base casting.

9) Perform theta assembly adjustment and theta assembly backlash adjustment (see tasks 4.19-4.20).

10) Reverse procedure to install remaining components.

11) Perform chuck flatness adjustment (see task 4.21).

3.35 REPLACE THETA WORM WHEEL ASSEMBLY
Part #12005450-002
See page 7-23

1) Remove front tray (see task 3.9).

2) Remove ribbon cable connector from Z limit sensor PCB.

3) Remove four screws, washers and splash guard support from mounting plate.

4) Place paper clip through loop in end of powered spring cable, remove cable from cable retainer and slowly release cable into powered spring housing.

5) Remove four screws and washers from theta worm cover.

6) Remove theta worm cover and pivot bar from support.

7) Loosen screw on right side of worm drive support and slide support to the rear as far as it will go.

8) Move X stage assembly to the left to clear tray support plate and lift theta worm wheel assembly off Z drive assembly.

NOTE: THERE IS A DUPLICATE SET OF HOLES FOR MOUNTING THETA WORM WHEEL SUBASSEMBLIES 180° OFFSET FROM ORIGINAL MOUNTING HOLES.

NOTE: MAKE SURE Z BEARING AND INSIDE OF WORM WHEEL ARE CLEAN AND LIGHTLY LUBRICATED WITH SHELL TELLUS 32.

9) Install theta worm wheel assembly on Z drive assembly.

10) Install ribbon cable connector on Z sensor PCB.

11) Perform theta assembly adjustment and theta assembly backlash adjustment (see tasks 4.19-4.20).

12) Install front tray (see task 3.9).

13) Perform chuck flatness adjustment (see task 4.21).

3.36 REPLACE Z LIMIT SENSOR PCB ASSEMBLY
Part #12004500-001
See page 7-23

1) Remove front tray (see task 3.9).

2) Remove ribbon cable connector from Z limit PCB.

CAUTION: DO NOT DAMAGE Z FLAG OR Z LIMIT SENSOR WHILE REMOVING PCB ASSEMBLY.

3) Remove two screws and Z limit PCB from theta worm wheel.

4) Reverse procedure to install Z limit PCB.

5) Perform chuck flatness adjustment (see task 4.21).

3.37 REPLACE Z GUIDE BLOCK
Part #13026270-001
See page 7-23

1) Remove front tray (see task 3.9).

2) Remove screw and washer from one side of guide block.

3) Remove screw and washer from other side of guide block.

4) Reverse procedure to install guide block.

5) Perform chuck flatness adjustment (see task 4.21).

3.38 REPLACE CABLE RETAINER/CABLE CLAMP
Part #13001800-001/70503150-001
See page 23

1) Remove front tray (see task 3.9).

2) Install paper clip through loop in powered spring cable, remove cable from cable retainer and slowly release cable into powered spring housing.

3) Remove screw, splitlock washer, washer and cable clamp from cable retainer.

4) Remove screw, washer and cable retainer from theta worm wheel.

5) Reverse procedure to install cable retainer and cable clamp.

6) Perform chuck flatness adjustment (see task 4.21).

3.39 REPLACE Z DRIVE ASSEMBLY
Part #12026150-001
See page 23

1) Remove theta worm wheel (see task 3.35).

2) Remove ribbon cable connector from Z motor PCB.

3) Remove four screws, washers and Z drive assembly from mounting plate.

NOTE: MAKE SURE Z BEARING IS CLEAN AND LIGHTLY OILED WITH SHELL TELLUS 32 BEFORE INSTALLING.

4) Reverse procedure to install Z drive assembly.

5) Perform chuck flatness adjustment (see task 4.21).

3.40 REPLACE Z BEARING ASSEMBLY
Part #12026140-001
See page 7-27

1) Remove Z drive assembly (see task 3.39).

2) Remove six screws and washers from Z mounting ring.

3) Remove two screws and washers from Z nut housing.

NOTE: Z BEARING ASSEMBLY IS A MATCHED SET OF ITEMS. DO NOT DISTURB ORIENTATION OF ITEMS DURING REMOVAL.

4) Remove Z bearing assembly from Z nut and leadscrew.

5) Reverse procedure to install Z bearing assembly.

6) Perform chuck flatness adjustment (see task 4.21).

3.41 REPLACE Z MOTOR ASSEMBLY
Part #12026630-001
See page 7-27

1) Remove Z bearing assembly (see task 3.40).

2) Install three spacer rods between Z spring coupling plates.

3) Loosen clamp on motor shaft.

4) Remove four screws, washers and motor from coupling assembly.

NOTE: REMOVE ALL BURRS FROM MOTOR SHAFT PRIOR TO ASSEMBLY. REST MOTOR SHAFT ON TOOLING BALL BEFORE TIGHTENING CLAMP.

5) Reverse procedure to install motor.

6) Perform chuck flatness adjustment (see task 4.21).

3.42 REPLACE Z LEADSCREW
Part #13022280-001
See page 7-27

1) Remove Z bearing assembly (see task 3.40).

2) Install three spacer rods between Z spring coupling plates.

3) Loosen clamp on Z leadscrew and remove Z leadscrew.

NOTE: REST TOOLING BALL ON MOTOR SHAFT BEFORE TIGHTENING CLAMP.

4) Reverse procedure to install Z leadscrew.

5) Perform chuck flatness adjustment (see task 4.21).

3.43 REPLACE X LEADSCREW AND DBL SUPERNUT
Part #12006060-001
See page 7-7

1) Remove three screws, washers and front access panel from base casting.

2) Remove ribbon cable connector from X motor PCB.

3) Loosen set screw on X leadscrew clamp.

4) Remove two screws and washers from support.

5) Remove support with motor assembly from X leadscrew.

CAUTION: DO NOT DAMAGE X FLAG OR X LIMIT SENSOR WHILE REMOVING LEADSCREW

NOTE: X LEADSCREW AND DBL SUPERNUT ARE A MATCHED SET AND SHOULD NOT BE SEPARATED.

6) Remove X leadscrew with DBL supernut from pillow block bearing.

7) Reverse procedure to install X leadscrew with DBL supernut.

3.44 REPLACE X AXIS PILLOW BLOCK
Part #13029140-001
See page 7-7

1) Remove X leadscrew (see task 3.43).

2) Remove three screws, washers and pillow block from base casting.

3) Reverse procedure to install pillow block.

3.45 REPLACE MACHINED X LEADSCREW SUPPORT
Part #13004700-001
See page 7-7

1) Remove X leadscrew (see task 3.43).

2) Remove X motor assembly with coupling assembly.

3) Remove two screws, washers and support from base casting.

4) Reverse procedure to install support.

3.46 REPLACE X LIMIT SENSOR PCB ASSEMBLY
Part #12023800-001
See page 7-7

1) Move X stage to middle of its traversal.

2) Remove three screw and washers from PCB.

NOTE: DO NOT DAMAGE X FLAG OR SENSOR WHILE REMOVING PCB.

3) Remove ribbon cable connector from PCB while removing PCB and three spacers from base casting

4) Reverse procedure to install PCB.

3.47 REPLACE X-Y-THETA MOTOR ASSEMBLY
Part #12026230-002

1) Perform the following access steps to replace each motor assembly:

a) For X and theta motor assemblies, remove front tray (see task 3.9).
b) For Y motor assembly, lift top cover.

2) Remove ribbon cable connector from PCB on motor assembly.

3) Loosen set screw on motor side of coupling half.

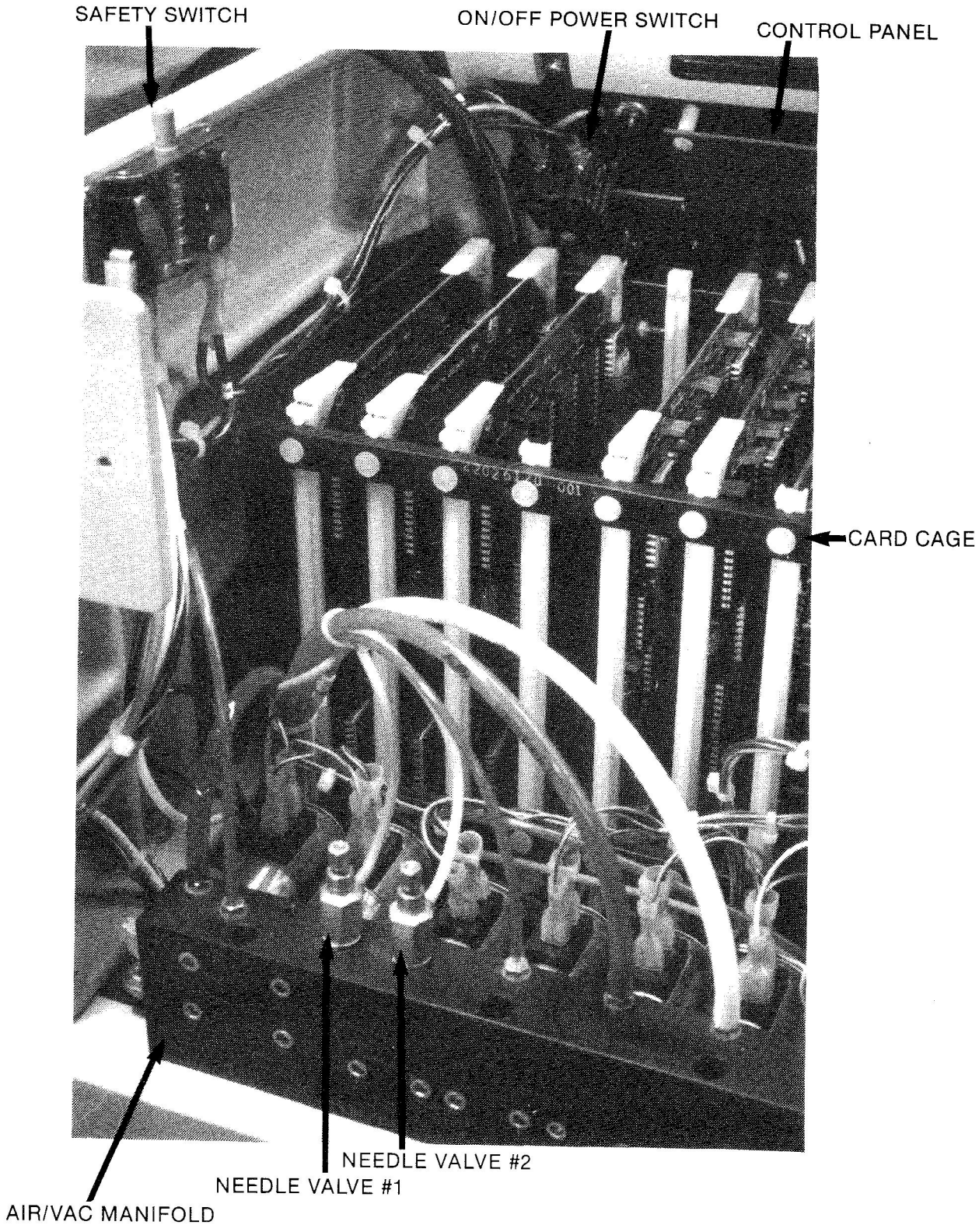


FIGURE 5
LEFT REAR OF SAW

4) Remove four screws, washers and motor assembly from support.

5) Reverse procedure to install motor assembly.

6) If replacing X or theta motor, perform chuck flatness adjustment (see task 4.21).

3.48 REPLACE MOTOR SENSOR PCB ASSEMBLY
Part #12030240-001, part #12015302-001 for Z motor interface
See page 7-49, 7-50

1) Perform the following access steps for each motor PCB:

   a) For the X and theta motor PCBs, remove front tray (see task 3.9).
   b) For the Z motor PCB, remove Z drive assembly (see task 3.39).
   c) For the Y motor PCB, lift top cover.

2) Remove motor cable connector from PCB.

   CAUTION: BE CAREFUL NOT TO DAMAGE ENCODER DISK.

3) Remove four screws, washers spacers and PCB from motor.

4) Reverse procedure to install PCB.

5) For theta, X and Z motor PCBs, perform chuck flatness adjustment (see task 4.21).

6) For X-Y-theta motors, perform stepper motor automatic balance and adjustment (see task 4.12).

3.49 REPLACE ENCODER DISK ASSEMBLY
Part #12002780-001

NOTE: Z MOTOR HAS NO ENCODER DISK.

1) Remove motor PCB assembly (see task 3.48).

2) Loosen set screw in clamp and remove encoder disk from shaft.

3) Reverse procedure to install encoder disk.

4) Perform stepper automatic balance and alignment (see task 4.12).

5) For X-theta motors, perform chuck flatness adjustment (see task 4.21).

OPTICAL

3.50 REPLACE MONITOR ASSEMBLY
Part #11029960-001
See page 7-10

1) Push saw power OFF.

2) Remove screw and support wedge from under monitor support bracket.

3) Loosen thumb screw on side of support bracket.

4) Remove plug P18 from jack J18 on mother/logic board.

5) Remove monitor from saw.

6) Reverse procedure to install monitor.

3.51 REPLACE MONITOR VIDEO CONTROLS ASSEMBLY
Part #12028940-001
See page 7-41

1) Push saw power OFF.

2) Remove four screws, washers and back panel from monitor.

3) Remove four screws, splitlock washers, washers and cover from monitor.

4) Remove plug P4 from monitor board regulator jack J4.

5) Remove four screws, washers and splitlock washers from CRT support tray.

6) Slide monitor assembly back from monitor bezel.

7) Remove three screws, washers and video controls from monitor.

8) Reverse procedure to install video controls.

3.52 REPLACE 100X FOLDED-OPTICS OR MONOCULAR CAMERA ASSEMBLY
Part #12026520-001 or 12032970-001
See figures 14 and 16

1) Push saw power OFF.

2) Pull sides of camera cover out and remove cover.

3) Disconnect camera jack J1.

4) Remove two air purge tubes and blowoff tube from barbs on rear of optics body.

5) Remove rear nozzle housing (see task 3.11).

6) Loosen two screws clamping spindle plate to camera mount and spindle housing.

7) Loosen two screws clamping camera support mount to camera mount.

8) Remove camera assembly and spindle plate from spindle housing and camera mount.

9) Remove screw, washer, spring and spindle plate from camera assembly.

10) Reverse procedure to install camera assembly.

11) Perform rear housing position alignment adjustment (see task 4.11).

12) Perform camera alignment adjustments (see tasks 4.24, 4.28, 4.29, 4.36-4.39).

3.53 REPLACE CAMERA
Part #s 12026520-001, 12032970-001 or 11029100

1) Push saw power OFF.

2) Remove mother board camera harness connector J1 from camera plug P1.

3) Remove two connectors from lamp assemblies.

4) Remove large screw and washer at back plate next to spring and remove camera.

5) Reverse procedure to install camera.

6) Perform camera alignment adjustments (see tasks 4.24, 4.28, 4.29, 4.36-4.39).

3.54 REPLACE OPTICS BODY
Part #13022680-001 or 13031540-001

1) Push saw power OFF.

2) Remove camera cover.

3) Remove two connectors from lamp assemblies.

4) Remove two screws and washers from optics body.

5) Remove two wafer blow-off and one air purge tube from barbed fittings on rear of optics body.

6) Reverse procedure to install optics body.

7) Perform camera alignment adjustments (see tasks 4.24, 4.28, 4.29, 4.36-4.39).

ELECTRICAL

3.55 REPLACE ON/OFF POWER SWITCH:
Part #72506260-001

1) Push saw power OFF.

2) Remove control panel (see task 3.57).

3) Remove screw from rear of power switch.

4) Remove jam nut and power switch from control panel.

5) Reverse procedure to install power switch.

3.56 REPLACE PROGRAM PANEL:
Part #11029540
See page 7-6

1) Push saw power OFF.

2) Lift top cover.

3) Pull spindle control board out for access.

4) Pull ribbon cable connector off program panel.

5) Loosen three screws, slide tabs away and remove program panel from front panel.

6) Reverse procedure to install program panel.

3.57 REPLACE CONTROL PANEL:
Part #11029550
See page 7-6

1) Push saw power OFF.

2) Lift top cover.

3) Pull ribbon cable connector off control panel.

4) Pull speaker connector off control panel.

5) Remove two screws, speaker and standoffs from control panel.

6) Pull two air blow off tubes off air

regulator.

7) Remove two screws, lockwashers and wires from ON/OFF switch.

8) Remove nut, lockwasher and green ground wire from ON/OFF switch.

9) Loosen three screws, slide tabs away and remove control panel from front panel.

10) Reverse procedure to install control panel.

3.58 REPLACE CARD CAGE ASSEMBLY
Part #11023960
See page 7-6

1) Turn saw power OFF.

NOTE: FOR REMOVAL OR REPLACEMENT OF CIRCUIT CARDS C1-C8, ONLY PERFORM STEPS 1-3 AND ONLY FOR SUSPECTED FAULTY CARD.

NOTE: BEFORE REPLACING A SUSPECTED FAULTY CARD WITH A NEW ONE, YOU MAY WANT TO SUBSTITUTE A SPARE OR INTERCHANGEABLE CARD FIRST.

2) Lift top cover.

NOTE: BRACKETED CARDS ARE INTERCHANGEABLE.

3) Lift tabs at top of card cage and remove:

circuit card	from
HOUSEKEEPER	XA1
X-T CPU	XA2
Y-Z CPU	XA3
VIDEO GENERATOR	XA5
SPINDLE LOGIC	XA6
X-Y DRIVER	XA7
T-Z DRIVER	XA8

4) Remove the following connectors from mother/logic board jack:

connector	jack
FRONT PANEL	J9
LOCAL BUSS	J10
SPINDLE INTERFACE	J11
X-Y AXIS	J12
T-Z AXIS	J13
WATER MANIFOLD	J14
AIR/VAC MANIFOLD	J15
CAMERA	J16
AUXILIARY	J17
MONITOR	J18
POWER INPUT	J25
SPINDLE BRUSH	J27

CAUTION: DO NOT DAMAGE SENSOR WHEN REMOVING TUBE. PULL TUBE STRAIGHT OFF SENSOR WHILE HOLDING SENSOR.

5) Remove tube from air sensor.

6) Remove tube from vacuum sensor.

7) Remove screw, washer and camera to mother/logic board cable clamp from card cage.

8) Remove four screws, splitlock washers and card cage with mother-/logic board from supports.

9) Reverse procedure to install card cage assembly.

10) Perform air and vacuum pressure sensor adjustments (see task 4.8-4.9).

3.59 REPLACE SPINDLE CONTROL PCB ASSEMBLY
Part #12028900-001
See page 7-5

1) Push saw power OFF.

2) Lift top cover.

3) Remove spindle control card from guides and jack J4 on mother board power supply.

4) Reverse procedure to install spindle control.

3.60 REPLACE SPINDLE DRIVE PCB ASSEMBLY
Part #12023220-001
See page 7-5

1) Push saw power OFF.

2) Lift top cover.

3) Remove four screws, splitlock washers, flat washers and spindle drive from spacers on power supply motherboard.

4) Reverse procedure to install spindle drive.

3.61 REPLACE POWER SUPPLY MOTHERBOARD PCB ASSEMBLY
Part #12023190-001
See page 7-5

1) Push saw power OFF.

2) Lift top cover.

3) Remove spindle control PCB assembly (see task 3.59).

4) Remove spindle drive PCB assembly (see task 3.60).

5) Remove the following connectors from power supply motherboard:

connector	jack
POWER OUTPUT	P1
SPINDLE MOTOR	J2
TRANSFORMER T1	J3
SPINDLE CONTROLLER	J4
COMPUTER SPIN INTER	J5
LIGHTS	J6
TRANSFORMER T2	J7
SPINDLE DRIVE	J8

6) Remove program panel for access (see task 3.56).

7) Remove five screws, splitlock washers, flat washers and power supply motherboard from standoffs.

8) Reverse procedure to install power supply motherboard.

3.62 REPLACE T1 POWER SUPPLY TRANSFORMER
Part #41521980-001
See page 7-5

1) Remove power supply motherboard (see task 3.61).

2) Remove four screws, splitlock washers, flat washers from transformer T2.

3) Remove input lugs 1-8 from T1.

4) Set transformer T2, with leads attached, safely aside.

5) Remove four screws, splitlock washers, flat washers from transformer T1.

6) Remove transformer T1 from power well with T1 output harness attached.

7) Remove sixteen leads of T1 output harness from terminals on transformer T1.

8) Reverse procedure to install transformer.

3.63 REPLACE T2 POWER SUPPLY TRANSFORMER
Part #41521990-001
See page 7-5

1) Remove power supply motherboard (see task 3.59).

2) Remove four screws, splitlock washers, flat washers from transformer T2.

3) Lift transformer T2 out of power well and remove fifteen leads from terminals on transformer T2.

4) Reverse procedure to install transformer.

3.64 REPLACE PRIMARY INPUT POWER PANEL
Part #11024040-001
See page 7-5, 7-55

1) Push saw power OFF.

2) Lift top cover.

3) Remove four screws, splitlock washers and flat washers from panel.

4) Remove panel from casting to gain access to TB1.

5) Remove power input receptacle from input power panel.

6) Remove eight leads from line filters FL1 and FL2.

7) Remove leads from fuse holders.

8) Loosen seventeen screws and remove leads from TB1.

9) Reverse procedure to install panel.

3.65 REPLACE PRIMARY INPUT PANEL RELAY

1) Remove card cage assembly (see task 3.58).

2) Remove six leads from relay.

3) Remove two screws and relay from base casting.

4) Reverse procedure to install relay.

3.66 REPLACE PRIMARY INPUT PANEL RESISTOR

1) Remove card cage (see task 3.58).

2) Remove two wires from terminals on resistor.

3) Remove two screws and resistor from base casting.

4) Reverse procedure to install surge suppressor.

3.67 REPLACE PRIMARY INPUT POWER DBL POLE SAFETY SWITCH
Part #12029280-001
See page 7-5

1) Push saw power OFF.

2) Lift top cover.

3) Remove four leads from DBL pole

switch.

4) Remove nut, washer and ground lead from switch.

5) Remove two screws, washers and switch from base casting.

6) Reverse procedure to install switch.

3.68 REPLACE PRIMARY INPUT POWER 3 AMP LINE FILTER FL2
Part #74512130-001
See page 7-33

1) Push saw power OFF.

2) Lift top cover.

3) Remove four screws, splitlock washers and flat washers from panel.

4) Remove panel from casting to gain access to line filter.

5) Remove leads W16 from terminal A, W18 from terminal B, W17 from terminal C, W11 from terminal D and W14 from terminal E on FL2.

6) Remove two screws, washers and FL2 from top of 20 amp line filter FL1.

7) Reverse procedure to install FL2.

3.69 REPLACE PRIMARY INPUT POWER 20 AMP LINE FILTER FL1
Part #41521890-001
See page 7-33

1) Remove primary input power 3 amp line filter FL1 (see task 3.68).

2) Remove leads W20 from terminal A, W22 from terminal B, W17 from terminal C, W4 from terminal D and W10 from terminal E on FL1.

3) Reverse procedure to install FL1.

3.70 REPLACE OUTPUT T1 TRANSFORMER HARNESS
Part #14029350-001
See page 7-34

1) Remove power supply motherboard (se task 3.61).

2) Remove leads T9-T24 from terminals T1.

3) Reverse procedure to install harnes

3.71 REPLACE T1-T2 POWER HARNESS
Part #14030910-001
See page 7-34

1) Remove power supply motherboard (se task 3.61).

2) Remove four screws, splitlock washe and flat washers from panel.

3) Remove panel from casting to gain a cess to TB1 and TB2.

4) Loosen screws and remove leads from TB1-1 through TB1-8 and from TB1-10 through TB1-17.

5) Remove wire W25 from chassis ground and TB2.

6) Remove wire W24 from TB2.

7) Remove leads from T1-1 through T1-8 on T1.

8) Remove leads from T2-1 through T2-15 on T2.

9) Reverse procedure to install T1-T2 power harness.

3.72 REPLACE POWER TO LOGIC MOTHERBOARD HARNESS
Part #14029330-001
See page 7-36

1) Remove plug P25 from logic motherboard jack J25.

2) Remove jack J1 from power supply motherboard jack J1.

3) Reverse procedure to install harness.

3.73 REPLACE AIR-VAC MANIFOLD ELECT HARNESS
Part #14031090-001
See page 7-16

1) Remove plug P15 from mother/logic board jack J15.

2) Pull off two leads each from solenoids L1-L5 on air-vac manifold.

3) Reverse procedure to install harness.

3.74 REPLACE WATER/ELECT SOLENOID HARNESS
Part #14031140-001
See page 7-15

1) Remove plug P14 from mother/logic board jack J14.

2) Remove two leads from solenoids L6 L9.

3) Remove screw and two leads from wat sensor.

4) Reverse procedure to install harnes

3.75 REPLACE SPINDLE BRUSHES

1) Loosen two screws and remove wire leads from spindle brushes.

2) Remove spindle brushes from rear of spindle.

3.77 REPLACE FUSES
See page 7-35, 7-34

The following table lists the location and amperage of all replaceable fuses found in the 1100 saw:

LOCATION	FUSE #	AMPERAGE
Primary Input Power	F1	8
Primary Input Power	F2	8
Primary Input Power	F3	2
Primary Input Power	F4	2
Power Supply Motherboard	F1	8
Power Supply Motherboard	F2	8
Power Supply Motherboard	F3	15
Power Supply Motherboard	F4	8
Power Supply Motherboard	F5	10
Power Supply Motherboard	F6	2.5
Power Supply Motherboard	F7	2
Power Supply Motherboard	F8	2
Power Supply Motherboard	F10	1
Power Supply Motherboard	F11	1
Power Supply Motherboard	F12	1
Power Supply Motherboard	F13	2
Power Supply Motherboard	F14	2

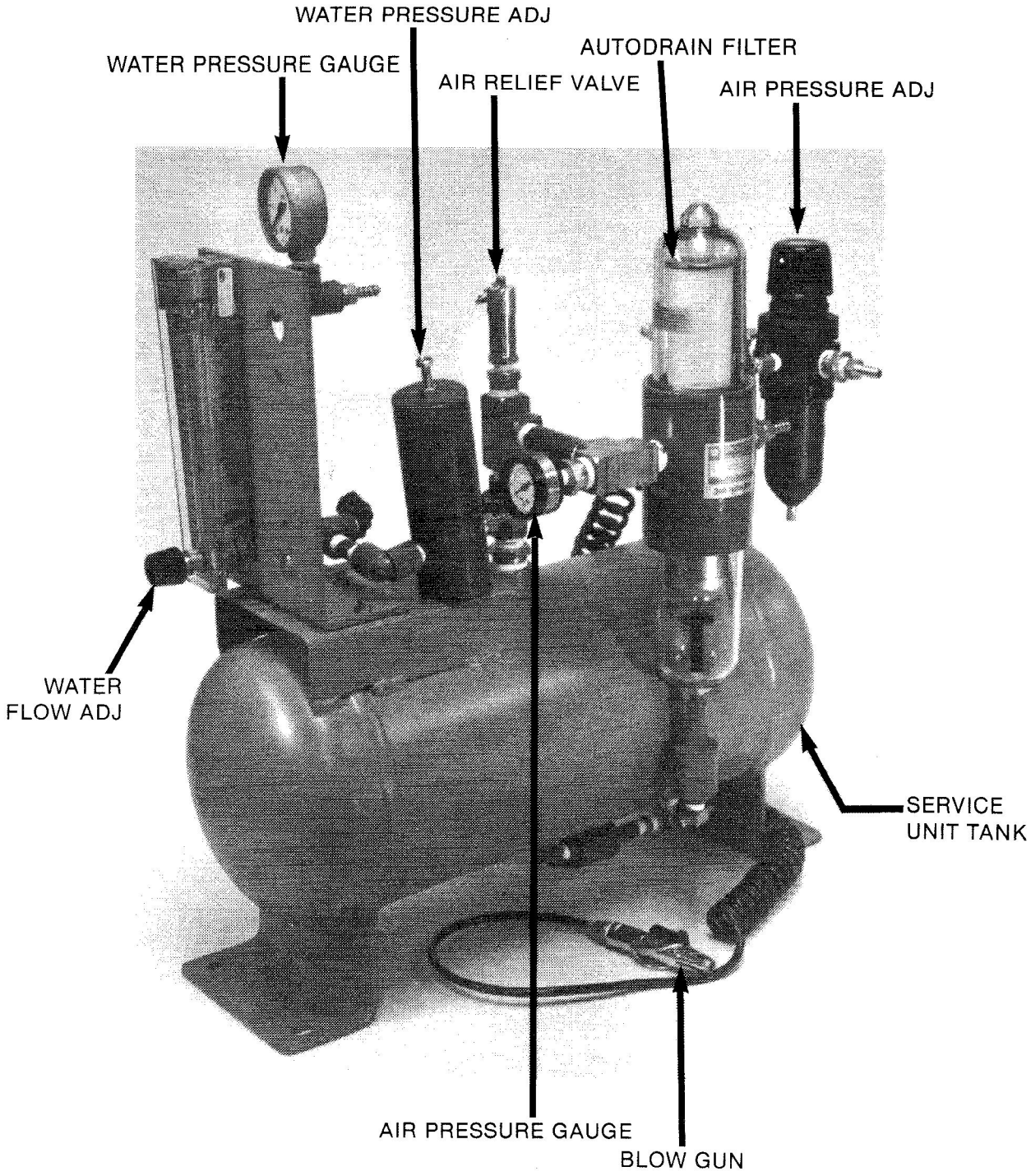


FIGURE 6
SERVICE UNIT

SECTION 4 (Adjustments)

4.1 SERVICE UNIT AIR PRESSURE ADJUSTMENT
See figure 6

NOTE: TO LOCK ADJUSTMENT, PULL KNOB UP UNTIL IT CLICKS

1) Turn cap on air pressure regulator until air pressure gauge reads 80 PSI.

4.2 SERVICE UNIT WATER FLOW
See figure 6

1) Activate WATER TEST function (see operator manual).

2) Turn knob on water guage until water gauge reads 40 GPH.

4.3 SERVICE UNIT WATER PRESSURE
See figure 6

1) Loosen jam nut on top of water regulator.

2) Turn screw on top of water regulator until water pressure gauge reads 25 PSI.

3) Tighten jam nut on top of water regulator.

4.4 WAFER BLOW-OFF VOLUME
See figure 5

1) Program saw in MODE 910 (see operator manual).

2) ALIGN test wafer under camera (see operator manual).

3) Pour water to completely cover wafer.

4) Alternate pressing of ALIGN and INDEX to activate wafer blow-off.

5) Adjust needle valve #2 attached to yellow tube on air/vac manifold until a 3/4 inch diameter dry area is blown off wafer under each lens.

4.5 AIR PURGE
See figure 5

1) Adjust needle valve #1 attached to orange tube on air/vac manifold to set flow rate as required to keep water off lenses.

4.6 VACUUM CHUCK UNLOCK AIR PRESSURE

NOTE: CHUCK SHOULD BE WET DURING THIS ADJUSTMENT TO ALLOW SUCTION TO BUILD UP BETWEEN CHUCK AND WAFER.

1) Program saw in MODE 910 (see operator manual).

2) Press CHUCK ZERO.

3) Set wafer on chuck and press WAFER LOCK.

4) Rotate air regulator CCW to lowest volume.

5) Gradually increase air regulator volume until wafer is just released by pressing WAFER RELEASE.

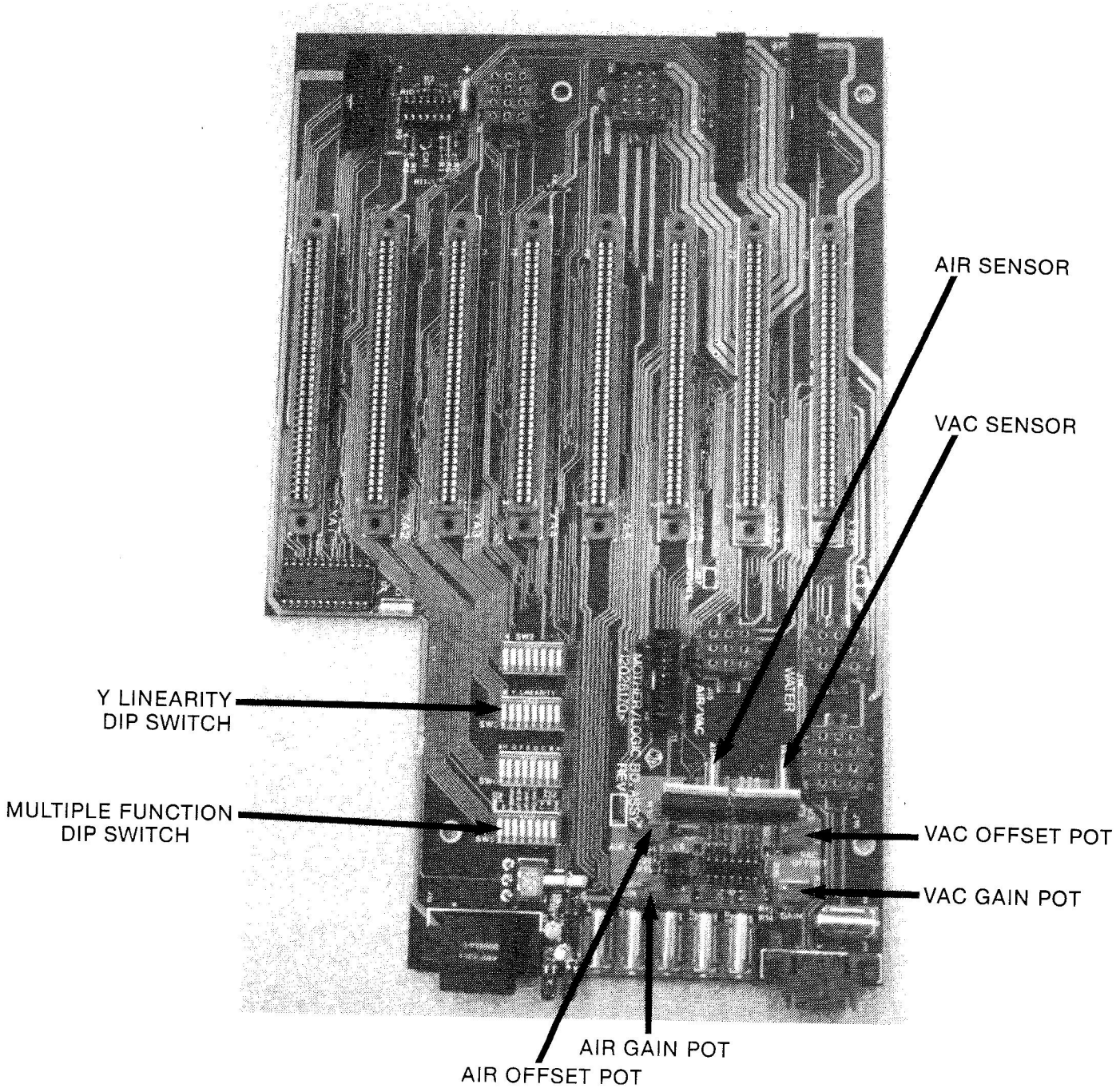


FIGURE 7
MOTHER/LOGIC BOARD

4.7 CUTTING WATER PRESSURE SENSOR ADJUSTMENT
See figure 4

1) Turn saw power OFF.

2) Adjust water pressure from service unit to 5 PSI (see task 4.3).

3) Remove four screws, splitlock washers, washers and rear pneumatics panel from base casting to gain access to sensor.

4) Place ohmeter leads on common (C) and normally open (NO) terminals.

5) Adjust sensor to where ohmeter changes reading between continuity and open.

6) Adjust water pressure on service unit to 25 PSI (see task 4.3).

7) Install rear pneumatics panel, four washers, splitlock washers and screws to base casting.

4.8 SPINDLE AIR PRESSURE SENSOR ADJUSTMENT
See figure 7

1) Program saw in MODE 817 (see operator manual).

2) Adjust air pressure on service unit to near 0 PSI (see task 4.1).

3) Turn AIR OFFSET potentiometer on mother/logic board until pressure indicated on saw display is higher than air pressure on service unit, then lower adjustment until it equals pressure on service unit.

4) Adjust air pressure on service unit to 80 PSI.

5) Turn AIR GAIN potentiometer until pressure indicated on saw display equals 80 ± 5 PSI.

6) Repeat steps 2-5 to insure linearity.

4.9 VACUUM PRESSURE SENSOR ADJUSTMENT.
See figure 7

1) Program saw in MODE 817 (see operator manual).

2) Remove incoming vacuum tube from rear pneumatics panel vacuum fitting.

NOTE: NEEDLE VALVE SHOULD VENT TO ATMOSPHERE.

3) Insert vacuum gauge and tee with needle valve between vacuum tube and vacuum fitting.

4) Open needle valve to adjust incoming vacuum near 0 Hg.

5) Turn VAC OFFSET potentiometer on mother/logic board until some vacuum pressure is indicated on saw display then reverse adjustment until vacuum on saw display equals vacuum indicated on service unit vacuum gauge.

6) Close needle valve to adjust incoming vacuum to 20 Hg.

7) Turn VAC GAIN potentiometer until vacuum indicated on saw display reads 20 ± 2 Hg.

8) Remove vacuum gauge and tee with needle valve from vacuum line and vacuum fitting.

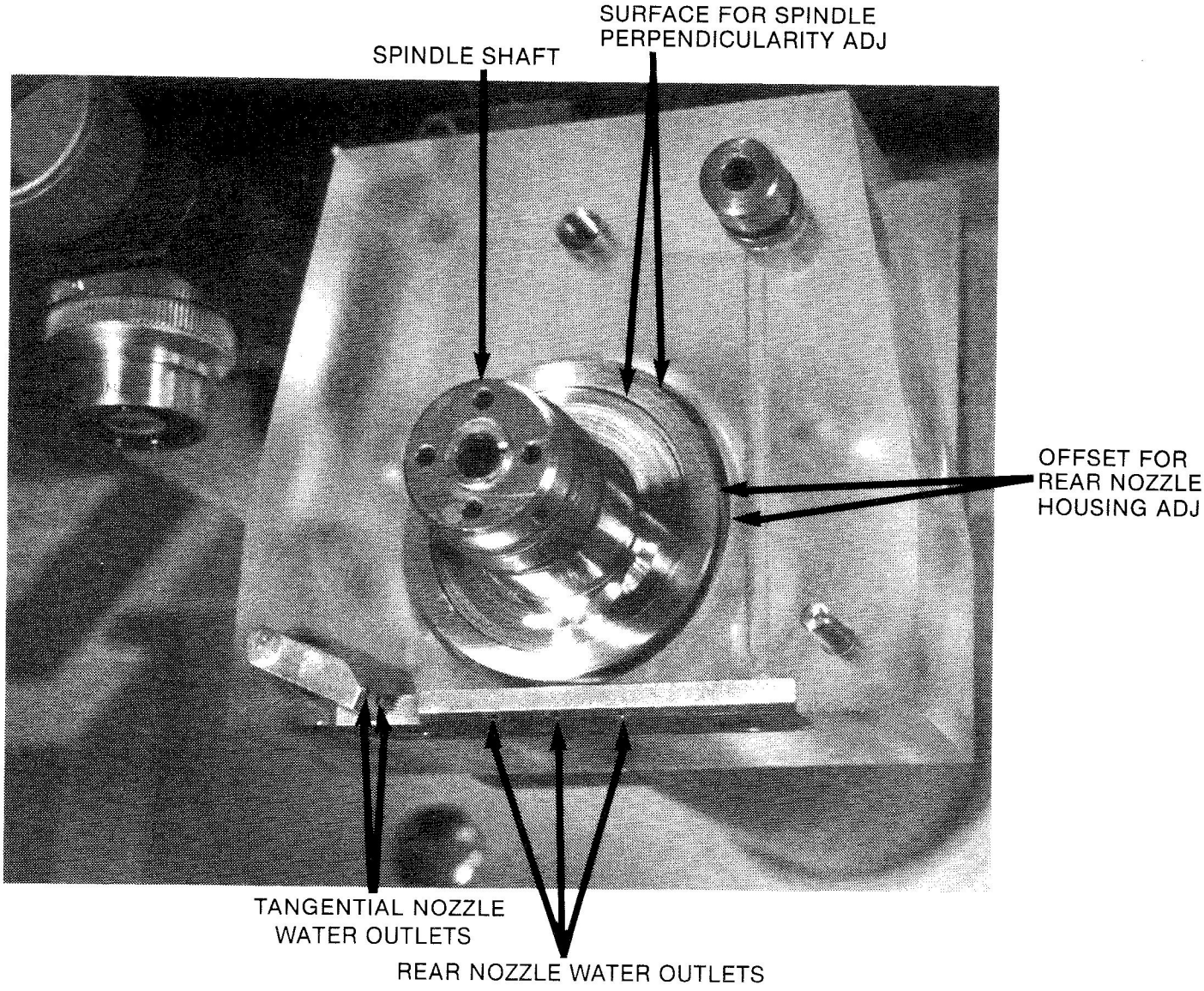


FIGURE 8
REAR NOZZLE HOUSING ASSY

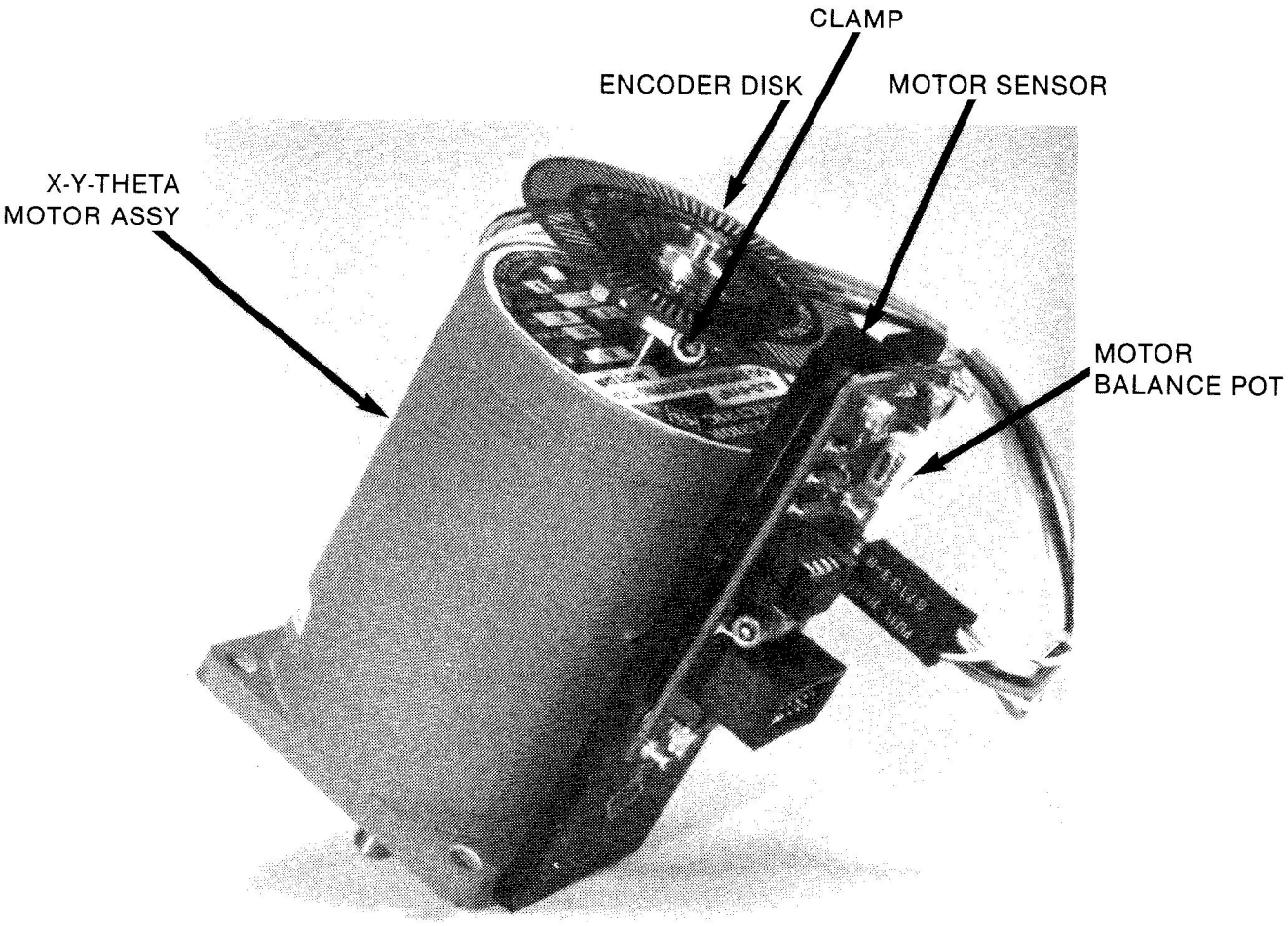


FIGURE 9
X-Y-THETA MOTOR ASSY

9) Install vacuum line on rear pneumatics panel vacuum fitting.

4.10 TANGENTIAL SPRAY NOZZLE ADJUSTMENT
See figure 8

1) Remove front nozzle housing (see task 3.10).

2) Put finger over water port in rear nozzle housing.

3) Perform WATER TEST function (see operator manual).

NOTE: TANGENTIAL SPRAY NOZZLE SET SCREW MUST BE ONLY HALF TIGHT TO ALLOW SPRAY NOZZLE TO BE HAND ADJUSTED.

4) Move tangential spray nozzle in or out of rear nozzle housing so that blade is centered in water flow.

5) Turn tangential spray nozzle up or down so that water flow strikes blade 1/8 inch above where water flow would be tangent to blade.

6) Install front nozzle housing.

4.11 REAR NOZZLE HOUSING POSITION ALIGNMENT
See figure 8

1) Remove front nozzle housing (see task 3.10).

2) Loosen two set screws securing spindle plate to optics mount.

3) Loosen set screw securing spindle plate to spindle housing.

4) Move face of rear nozzle housing to .09-.11 inches behind spindle face.

5) Tighten set screw to secure spindle plate to spindle housing.

6) Tighten two set screws to secure spindle plate to optics mount.

7) Install front nozzle housing.

8) Align reticle to cut angle (see tasks 4.34 and 4.39).

4.12 STEPPER MOTOR AUTOMATIC BALANCE AND ALIGNMENT
See figure 8

NOTE: BALANCE AND ALIGNMENT ADJUSTMENTS ARE INTERACTIVE AND SHOULD BOTH BE RECHECKED AFTER ANY ADJUSTMENT.

NOTE: ALWAYS CHECK BALANCE ADJUSTMENT FIRST.

1) Perform the following step to access stepper motors.

   a) For X and theta motor, remove three screws, washers and front access panel.
   b) For Y motor, lift top cover.

2) Program saw in the following modes to balance and align motors (see operator manual).

MODE	FUNCTION
801	X motor balance test
802	X motor alignment test
803	Y motor balance test
804	Y motor alignment test
805	T motor balance test
806	T motor alignment test

NOTE: NO ADJUSTMENT IS REQUIRED IF

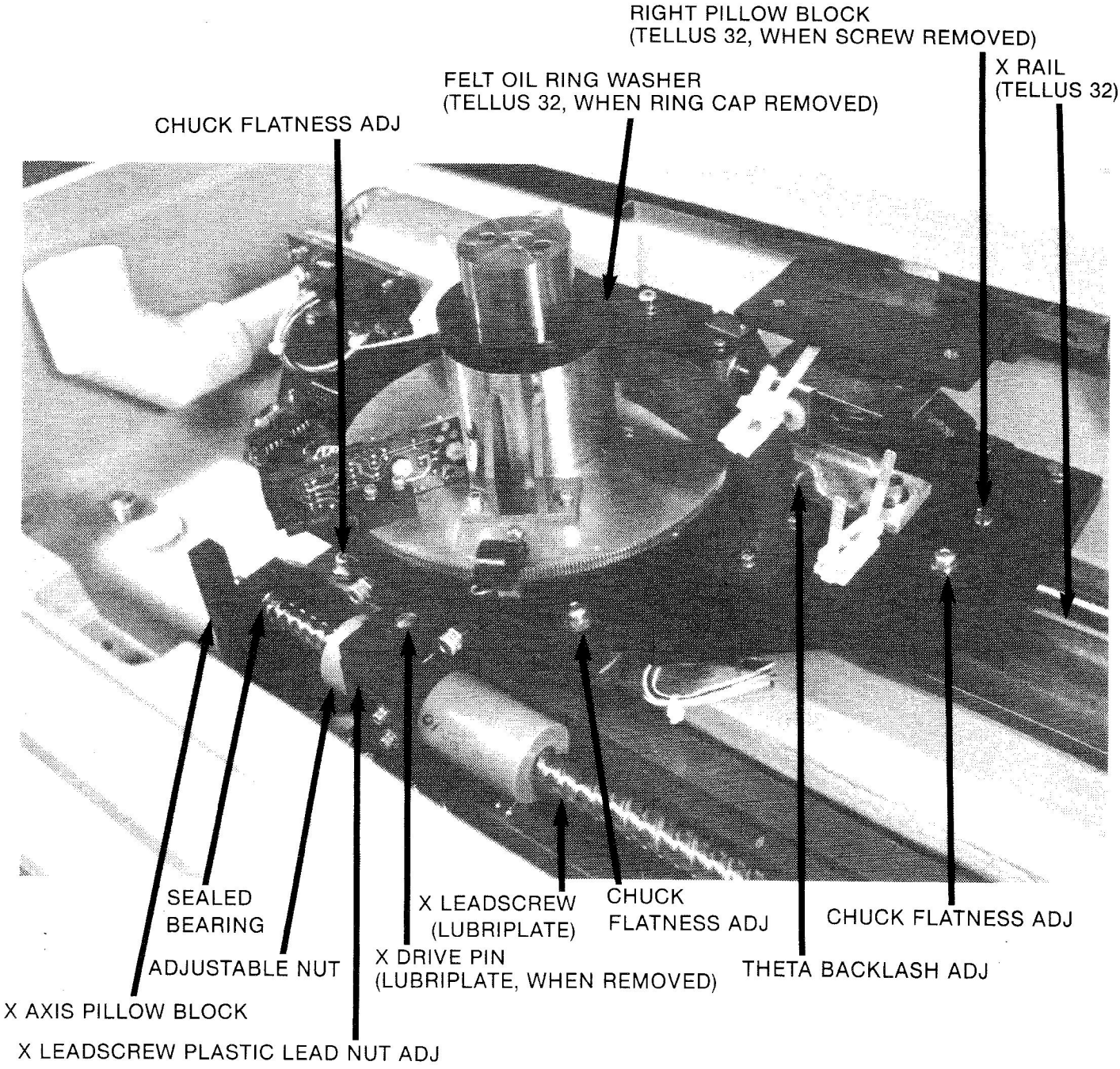


FIGURE 10
X STAGE ASSY AND X LEADSCREW ASSY

DISPLAY READS 100 ± 8.

NOTE: ACCESS TO SET SCREW ON CLAMP CAN BE HAD THROUGH EITHER OF TWO HOLES IN MOTOR SENSOR BOARD.

3) Adjust motor balance by slightly loosening clamp set screw and gently tapping clamp to move encoder disk.

4) For fine adjustment, loosen motor PCB screws and move the PCB board.

NOTE: MOTOR MAY NOT TURN. IF MOTOR DOES NOT TURN DURING STEP 5, TURN POTENTIOMETER NEAR MIDDLE OF ITS ROTATION.

5) Press ENTER after each balance adjustment until value displayed is 100 ± 5.

6) Tighten set screw on encoder disk shaft and tighten screws on motor PCB.

7) Adjust motor alignment by turning potentiometer on motor sensor board.

8) Press ENTER after each alignment adjustment until value displayed is 100 ± 5.

NOTE: PRESS ENTER SEVERAL TIMES EACH FOR MOTOR ALIGNMENT AND BALANCE TO MAKE SURE BOTH VALUES ARE WITHIN ACCEPTABLE RANGE.

9) Reverse step 1 to install parts removed for accessing.

4.13 LOOSE X LEADSCREW ADJUSTMENT
See figure 10

1) Remove three screws, washers and front access panel.

2) Loosen two screws holding X leadscrew support to casting.

3) Push X leadscrew firmly against pillow block bearing.

4) Tighten two screws and X leadscrew support to casting.

5) Install parts removed in step 1.

4.14 ADJUST X LEADSCREW PLASTIC LEAD NUT
See figure 10

1) Remove three screws, washers and front access panel from base casting.

2) Loosen nut clamp screw.

3) Turn take-up lead nut CCW until wave spring washer does not touch nut holder.

4) Turn take-up lead nut CW until wave spring just makes contact with nut holder and take-up nut.

5) Turn take-up lead nut CW, 1/8 turn more, to slightly compress wave spring washer.

CAUTION :DO NOT OVER TIGHTEN NUT CLAMP SCREW OR BINDING OF TAKE-UP NUT WILL OCCUR.

6) Tighten nut clamp screw.

7) Adjustment was performed correctly if leadscrew operates smoothly without backlash or jerkiness.

8) Install front access panel, three washers and screws to base casting.

4.15 X FLAG ADJUSTMENT

1) Remove saw blade (see operator manual).

2) Mark center of spindle shaft.

3) Program saw in MODE 910 (see operator manual).

4) Perform CHUCK ZERO operation (see operator manual) and stop chuck when close to spindle by pushing saw power OFF.

5) Chuck center should be centered under mark on spindle shaft.

6) Remove three screws, washers and front access panel from base casting.

7) Loosen two screws and move X flag the opposite direction by amount reference mark is off chuck center.

8) Tighten two screws and X flag.

9) Repeat steps 4 through 8 until chuck center is under reference mark on spindle shaft.

10) Install front access panel, three washers and screws to base casting.

11) Install saw blade.

4.16 Y STAGE REPEATABILITY ADJUSTMENT
See figure 12

1) Lift back cover.

2) Loosen two screws holding Y leadscrew support to casting.

3) Push Y leadscrew firmly against front support block bearing.

4) Tighten two screws and Y leadscrew support to casting.

5) Remove bellows from rear of Y leadscrew adjustable nut.

6) Remove nut retaining pin from shaft.

7) Tighten adjustable nut 1/4 turn toward running nut.

8) Install nut retaining pin on shaft.

9) Install bellows on rear of Y leadscrew adjustable nut.

10) If required, tighten three screws in Y leadscrew ball holder.

11) If required, tighten Y motor coupling clamps.

12) Test for Y stage repeatability (see task 4.16).

4.16.1 TEST FOR Y STAGE REPEATABILITY

1) Program saw for index between test wafer streets (see operator manual).

2) Align first street of test wafer with reticle (see operator manual).

3) Index y axis forward then back along length of y axis.

4) If test wafer does not appear in same position under reticle (after indexing back to same position), perform Y stage repeatability adjustment (see task 4.16).

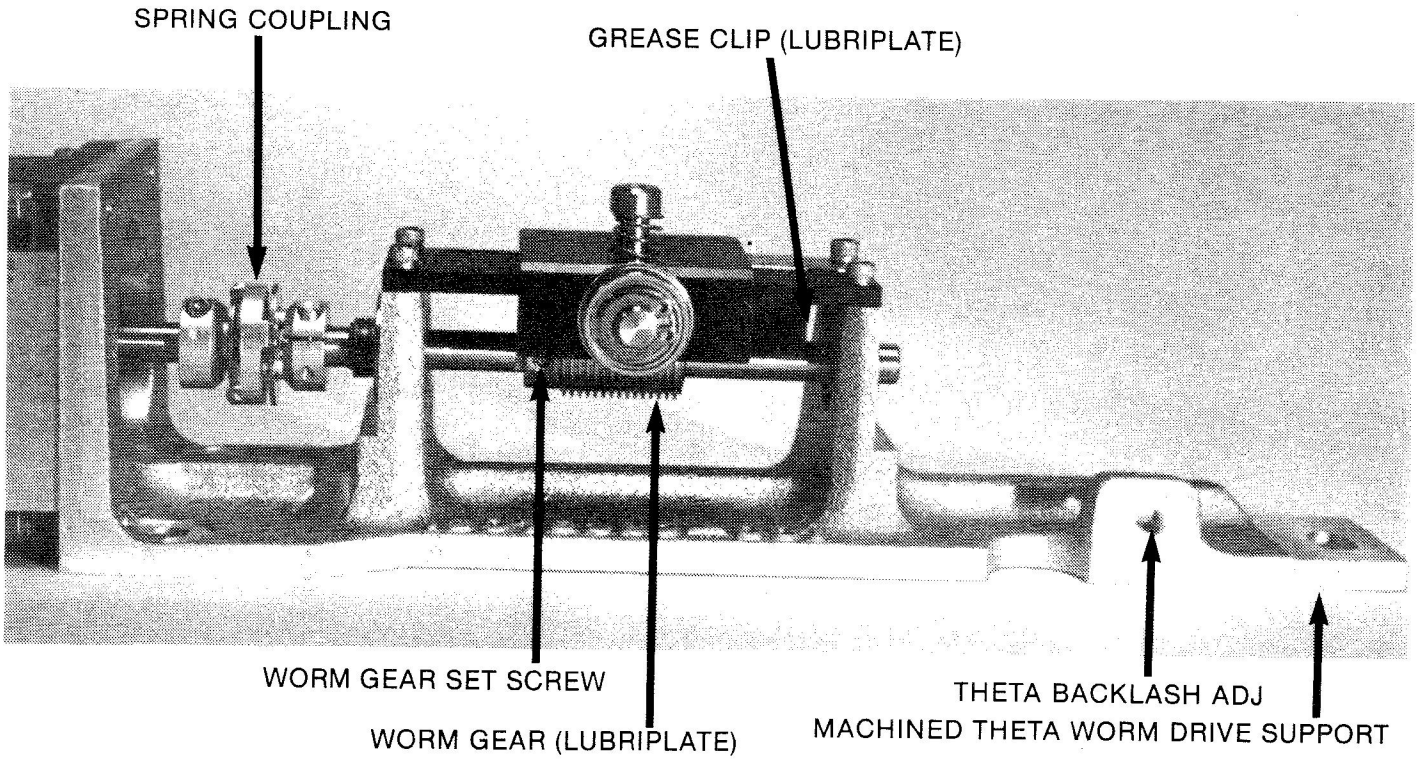


FIGURE 11
THETA STAGE ASSY

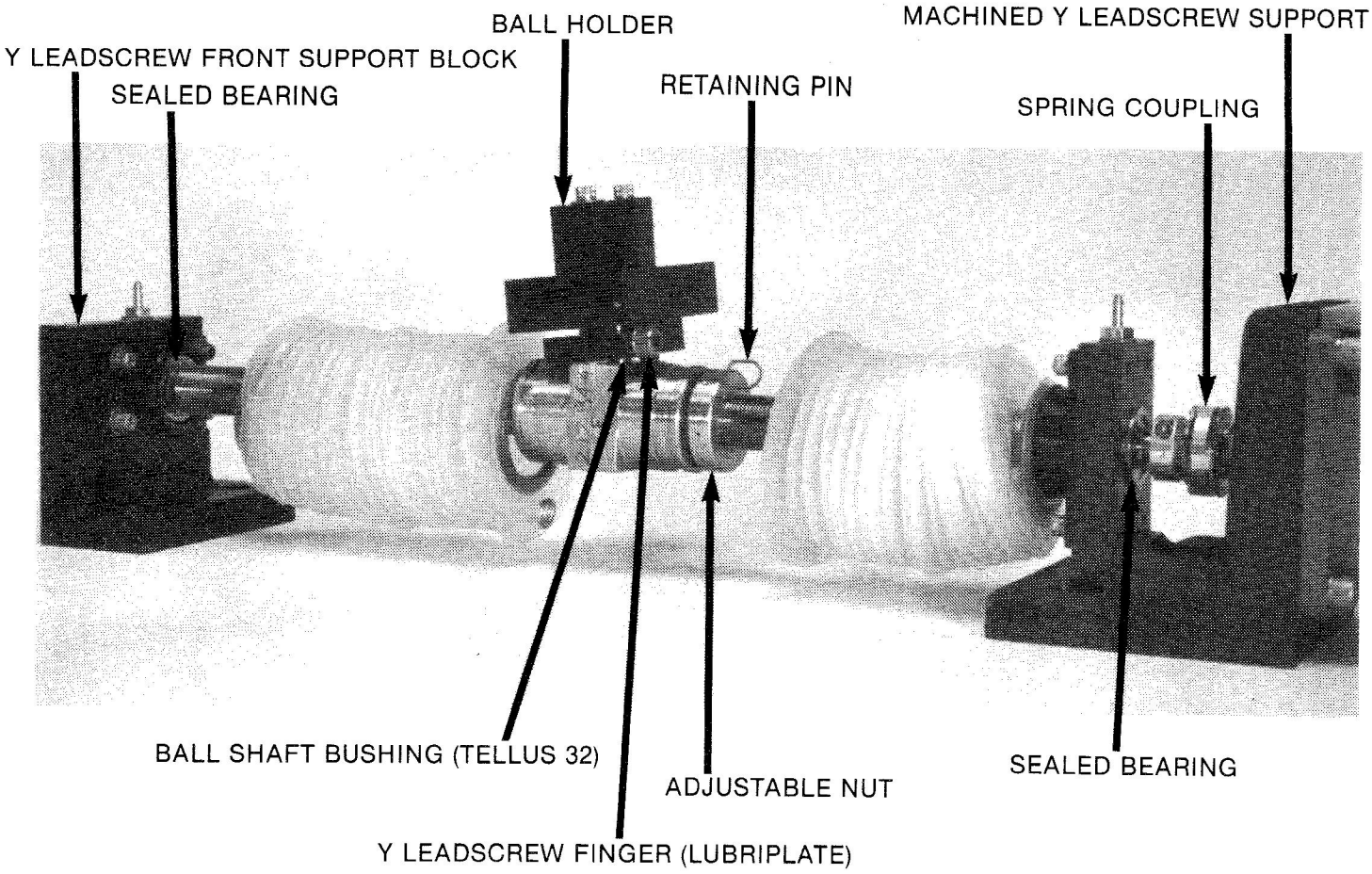


FIGURE 12
Y LEADSCREW ASSY

4.17 Y FLAG ADJUSTMENT

1) Program saw in MODE 22 (see operator manual).

2) Make two cutting passes on blank test wafer (see operator manual).

3) Using the Y axis joystick, scan wafer for intersection of first two cuts and note direction of movement.

4) Loosen two screws and move Y flag the opposite direction of offset in step 3.

5) Tighten two screws and flag.

6) Repeat step 2-4 until reticle is centered over intersection of two cuts without any joystick movement.

4.18 Y LINEARITY ADJUSTMENT

1) Program saw in MODE 816 (see operator manual).

2) Perform CHUCK ZERO function (see operator manual).

3) Place micro-mask on chuck so that diagonal of mask is centered along Y axis.

4) Press WAFER LOCK.

5) Use Y alignment joystick and monitor UP/DOWN knob to position reticle over -2.75 inch mark on wafer mask.

6) Press INDEX.

7) Use Y alignment joystick only and position reticle over +2.75 inch mark on front side of wafer mask.

8) Press ENTER.

9) Move Y alignment DIP switches on mother/logic board up or down according to the pattern indicated on monitor.

10) Repeat steps 5 through 9 until no more adjustments are required.

4.19 THETA WORM WHEEL ADJUSTMENT

See figure 3 for shim location

1) If required, remove front tray from saw (see task 3.9).

2) Place height gauge (PN 28016890) on worm wheel surface with LO notch over worm gear shaft.

3) If LO notch touches worm gear shaft, remove worm wheel (see task 3.35) and add shims over Z bearing.

4) Install worm wheel over Z bearing.

5) When the LO notch clears the worm gear shaft, turn the height gauge over with HIGH notch over worm gear shaft.

6) If HIGH notch does not touch worm gear shaft, remove worm wheel and remove shims from Z bearing.

7) Install worm gear over Z bearing.

8) Repeat steps 2-7 until LO notch clears and HIGH notch barely touches worm gear shaft when slid along worm wheel surface.

9) Install remainder of worm wheel assembly (see task).

10) Install front tray (see task 3.9).

11) Perform chuck flatness adjustment (see task 4.21).

4.20 THETA ASSEMBLY BACKLASH ADJUSTMENT
See figure 10

1) Clean theta worm wheel and theta worm gear (see task 2.11).

2) Loosen screw securing right side of theta worm drive support to X stage mounting plate.

3) Turn theta worm adjusting screw one turn CW.

4) Slide theta worm gear assembly so theta worm gear rests firmly against theta worm wheel.

5) Finger tighten screw securing theta support to X mounting plate.

6) Turn theta worm adjusting screw out until it contacts X splash guard support.

   NOTE: USE Y MICROMETER FEATURE (see below) TO MEASURE PLAY IN THETA WORM GEAR.

7) Turn theta worm adjusting screw CCW 1/12 of a revolution more to establish .001 inch play in gear.

To measure play in theta worm gear perform the following steps:

   a) Mount test wafer (see operator manual).
   b) Note position of reticle on wafer.
   c) Take up play in worm gear by pulling on worm wheel and holding.
   d) Press CLEAR on program panel.
   e) Move theta alignment joystick until reticle is in position noted in step b.
   f) program panel display reads distance traveled by theta axis (amount of play in gear.

8) Tighten screw securing theta support to X mounting plate.

9) Lubricate theta assembly (see task 2.11).

4.21 CHUCK FLATNESS TESTING AND ADJUSTMENT

1) Remove front nozzle housing (see task 3.10).

   NOTE: IN MOST CASES, IT IS SUFFICIENT TO PERFORM CHUCK FLATNESS ON THE TOP CHUCK. IF YOU SUSPECT A FAULTY TOP CHUCK, THEN PERFORM CHUCK FLATNESS ON BOTH THE TOP AND BASE CHUCK.

2) Remove top chuck from base chuck.

3) Install dial indicator on rear nozzle housing (see part #28033050-001).

4) Program the saw as follows:

1st index	1000
2nd index	1000
Height	100
Thickness	102
Angle	90°
Speed	1000
Diameter	6000
Mode	910

5) Perform CHUCK ZERO operation (see operator manual).

6) Position end of dial indicator to rest on base chuck where saw would touch.

7) Press INDEX.

8) Preload gauge to read .001 inch.

NOTE: NOTE READINGS OF DIAL INDICATOR DURING ALL MOVEMENTS OF CHUCK AND Y STAGE. IF ANY READINGS VARY MORE THAN .0004 INCHES, CHUCK FLATNESS NEEDS ADJUSTMENT.

9) Press wafer LEFT joystick until right edge of chuck is under end of dial indicator.

10) Press wafer RIGHT joystick until right edge of chuck is under end of dial indicator.

11) Press wafer RIGHT joystick until center of chuck is under dial indicator.

12) Press wafer FORWARD and BACK joysticks until the length of the chuck is traversed.

13) Press wafer CW and rotate chuck 90°.

14) Repeat steps 9 through 12 while rotated 90°.

NOTE: MAKE SURE CHUCK COMPONENTS ARE ASSEMBLED PROPERLY AND THAT CHUCK MOUNTING SURFACE IS CLEAN AND FREE OF IRREGULARITIES BEFORE PERFORMING ANY ADJUSTMENTS.

15) If no readings taken above varied by more than .0004 inches, no adjustments will be required.

NOTE: HEIGHT MAY DIFFER BUT FLATNESS SHOULD NOT

16) If left/right and forward/back readings varied differently when chuck was rotated 90°, continue with next step. If they were within .0004 inches of each other, skip steps 17-20.

17) Clean Z housing and chuck mating surfaces (see task 2.10).

18) Repeat steps 9-14.

19) If left/right and forward/back readings still varied differently after the chuck was rotated 90°, continue with next step. If they were within .0004 inches, skip step 20.

20) Replace Z bearing assembly (see task 3.40).

21) Move Y stage BACK two inches from chuck center line.

22) Move chuck LEFT and RIGHT all the way across indicator gauge.

23) Loosen sockethead screw next to right side X stage pillow block and turn jackscrew until right hand reading is equal to left hand reading.

24) Tighten sockethead screw on jackscrew.

25) Gently rap base casting to settle adjustment.

26) Move Y stage FORWARD two inches from chuck center line.

27) Move chuck LEFT and RIGHT all the way across indicator gauge.

28) Loosen sockethead screw on left side of roller support plate and turn jackscrew until right hand reading is equal to left hand reading.

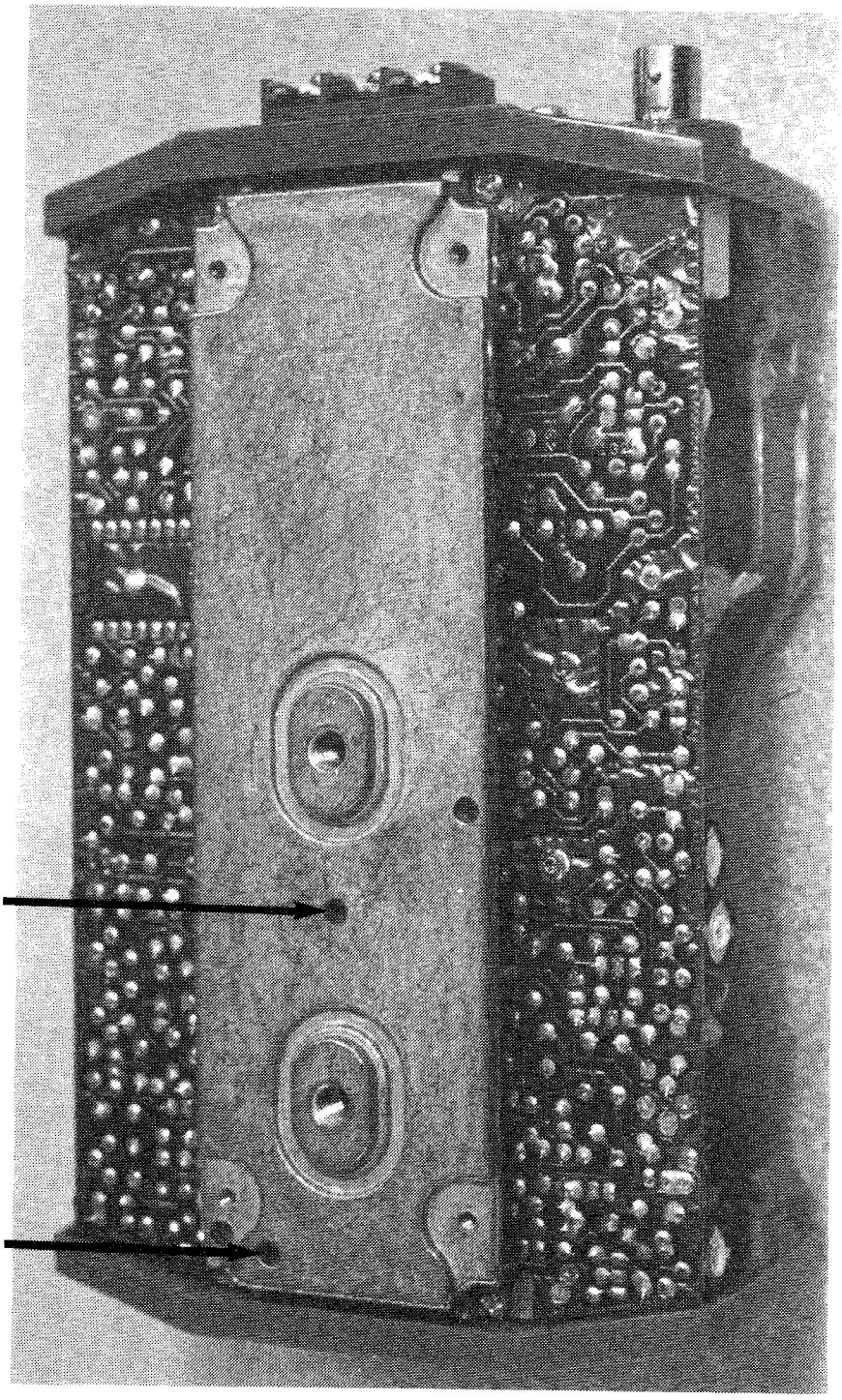


FIGURE 13
FOLDED OPTICS CAMERA (COVER REMOVED)

29) Tighten sockethead screw on jackscrew.

30) Gently rap base casting to settle adjustment.

31) Move chuck BACK and LEFT/RIGHT to position rear center part of chuck under indicator gauge.

32) Move chuck FORWARD all the way across indicator gauge.

33) Loosen sockethead screw on mounting plate over right side of leveling roller support and turn jackscrew until chuck measures flat, front to back.

34) Tighten sockethead screw on jackscrew.

35) Gently rap base casting to settle adjustment.

36) Repeat steps 9-14 until no readings vary more than .0004 inches.

NOTE: MAKE SURE THE UNDERSIDE OF TOP CHUCK AND TOP OF BASE CHUCK ARE FREE OF DIRT AND DEBRIS

37) If required, screw top chuck on base chuck.

38) If required, repeat chuck flatness test on top chuck.

39) Remove indicator gauge from rear nozzle housing.

40) Install front nozzle housing (see task 3.10).

4.22 SPINDLE PERPENDICULARITY TESTING AND ADJUSTMENT

1) Push saw power OFF.

2) Remove saw blade (see operator manual).

3) Unscrew top chuck from base chuck.

4) Install indicator gauge on center of base chuck (see part #28033440-001).

5) Place end of indicator gauge on outside rim of blade mounting surface face, just below level of spindle shaft.

6) Preload indicator gauge to read .001 inch.

CAUTION: DO NOT DAMAGE ENCODER DISK IN ANY WAY

7) Turn X motor encoder disk until end of dial indicator engages other side of mounting surface.

8) If indicator gauge reads within .0001 inch for two sides of mounting surface, skip steps 7-10.

9) Loosen four screws holding spindle casting to Y slide.

10) Adjust spindle casting so that two sides of mounting surface are within .0001 inch of each other.

11) Tighten four screws on spindle casting.

12) Repeat steps 3-6.

13) Remove dial indicator from rear nozzle housing.

14) Install saw blade (see operator

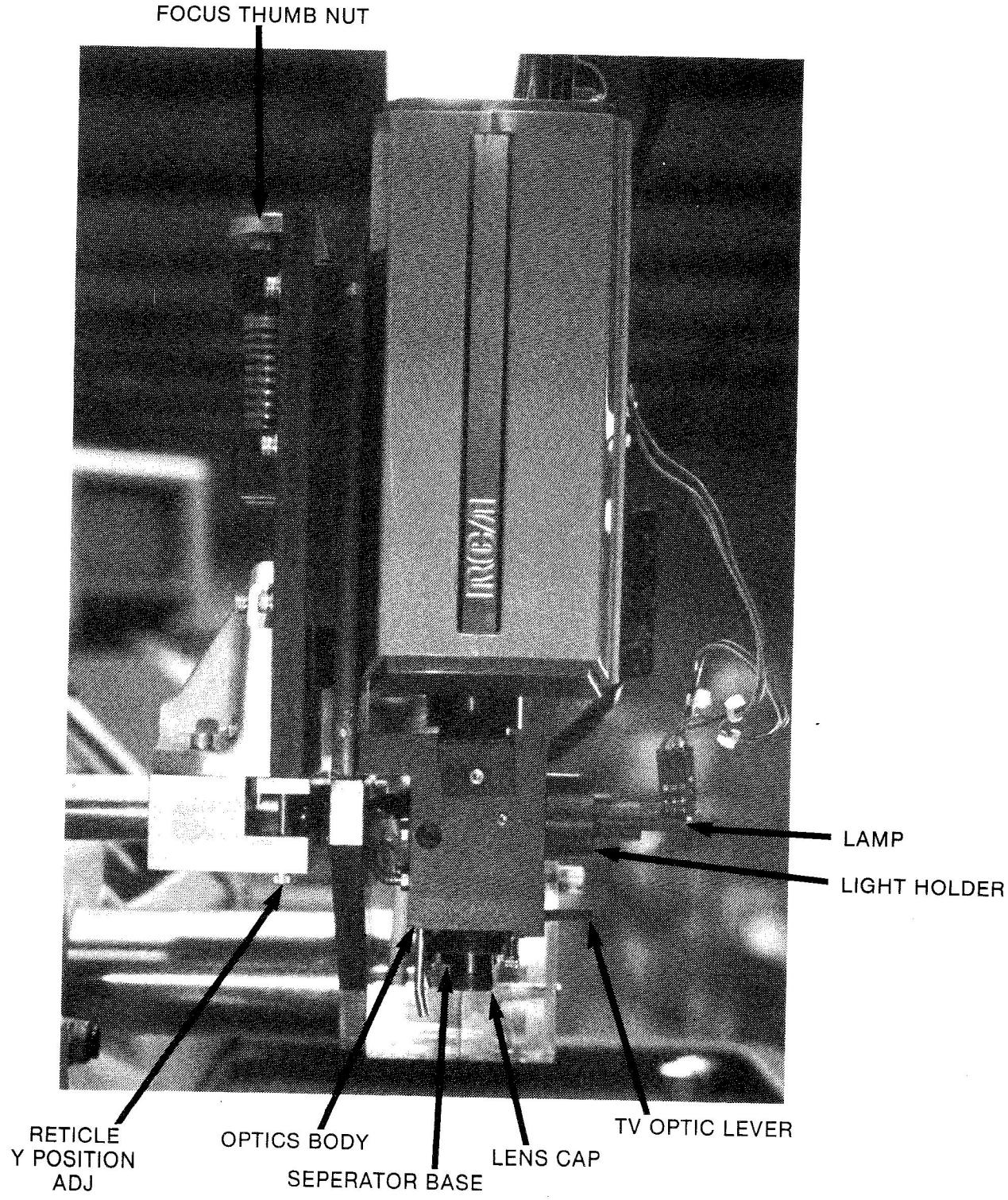


FIGURE 14
FOLDED OPTICS CAMERA

manual).

OPTICAL ADJUSTMENTS

4.23 SET-UP FOR OPTICAL ADJUSTMENTS.

NOTE: IF NO CUTS WILL BE MADE ON TEST WAFER, USE MICRO-MASK

1) Program saw for height and thickness of test wafer (see operator manual).

2) Perform CHUCK ZERO function.

3) Place wafer on vacuum chuck and press WAFER LOCK.

4) ALIGN wafer.

FOLDED-OPTICS CAMERA

4.24 FOCUS CAMERA
See figure 14

NOTE: THE 50X CAMERA LENS WILL NOT FOCUS TO AS CLEAR A PICTURE AS THE 100X CAMERA LENS.

1) Set-up for optical adjustments (see task 4.23).

2) Turn thumb nut on rear of camera assembly until right side image on monitor is in focus.

3) Unscrew lens cap from left side camera lens adapter.

4) Turn adjustment lens holder until left side image on monitor is in focus.

5) Screw lens cap on left side camera lens adapter.

CONTRAST ADJUSTMENTS

NOTE: CONTRAST ADJUSTMENTS ARE LISTED BY INCREASING LEVELS OF FINENESS. ONLY PERFORM FINE ADJUSTMENTS IF DESIRED LEVEL OF CONTRAST IS NOT ACHIEVED BY COARSE ADJUSTMENT.

4.25 For coarse adjustment:
See figure 15

1) Set-up for optical adjustments (see task 4.23).

2) Turn bottom pot on monitor heatsink panel to adjust contrast.

4.26 For video bias adjustment:

1) Set-up for optical adjustments (see task 4.23).

2) Remove back panel, cover and support tray from CRT.

3) From underneath monitor board, rotate pot R211 to achieve best contrast on monitor.

4) Install support tray, cover and back panel on CRT if contrast adjustment is complete.

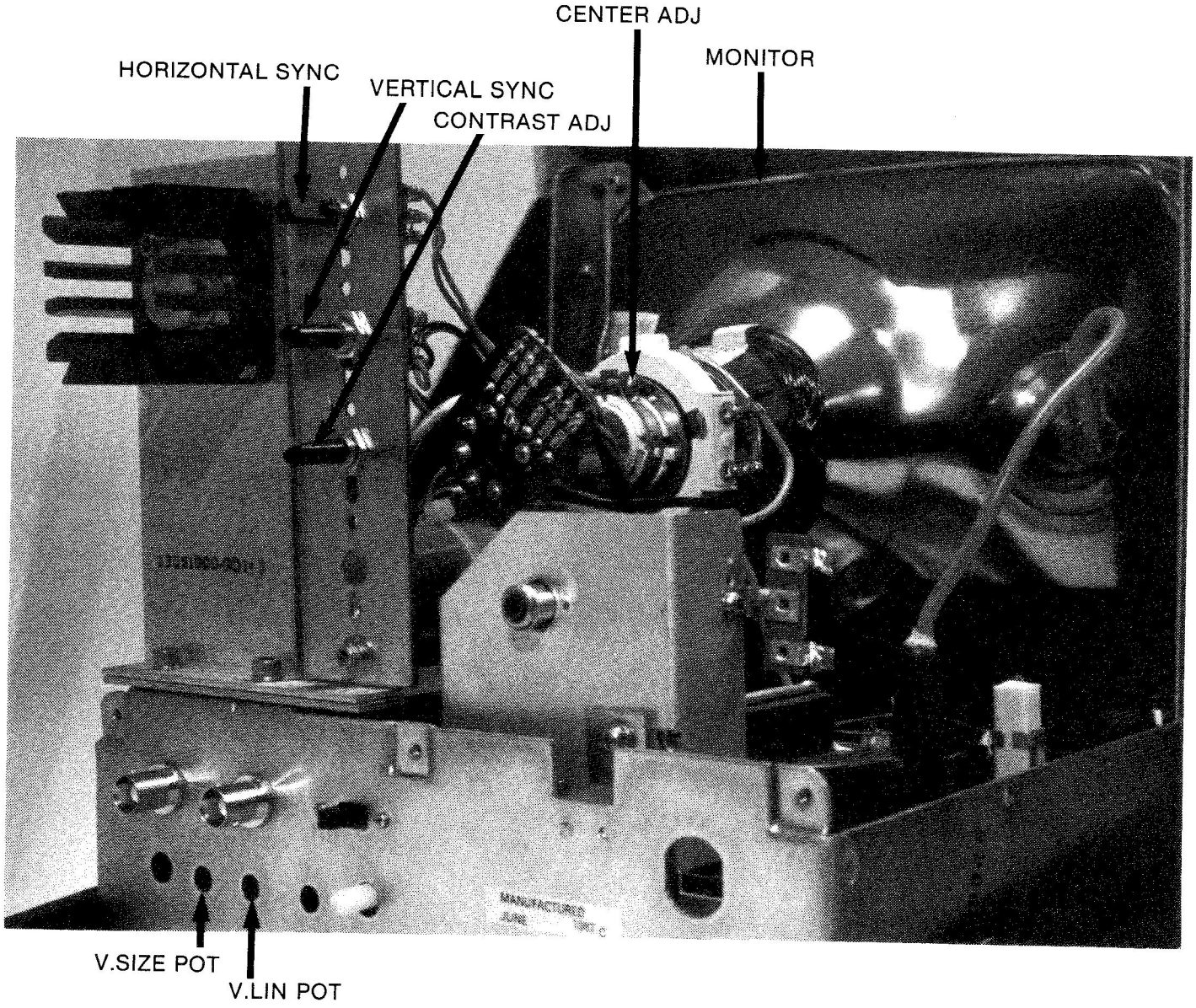


FIGURE 15
MONITOR

4.27 For gamma and video response adjustments:
See figure 13

1) Set-up for optical adjustments (see task 4.23).

2) Remove camera cover.

   NOTE: GAMMA CONTROL POT IS SET FULL CW AT FACTORY. ROTATING GAMMA CONTROL POT CAN GIVE MORE CONTRAST TO DARK AREAS.

   NOTE: IF ROTATION OF GAMMA CONTROL POT RESULTS IN EXCESSIVE NOISE FOR BLACK PORTION OF SCREEN, ADJUST VIDEO RESPONSE POT (see below).

3) Rotate gamma control pot (R88) CCW to stretch black portion of screen or CW to shrink black portion of screen.

   NOTE: VIDEO RESPONSE POT IS SET FULL CCW AT FACTORY FOR BEST RESOLUTION AND PICTURE DETAIL.

4) Rotate video response pot CW to eliminate noise in picture.

5) Install camera cover when adjustment is complete.

4.28 ILLUMINATION ADJUSTMENT
See figure 14

1) Set-up for optical adjustments (see task 4.23).

2) Loosen four screws securing TV light holder to optics body.

3) Loosen two set screws securing split beam mirror holder in optics body.

   NOTE: MOVE TV LIGHT HOLDER TO CONTROL SPLIT BEAM MIRROR HOLDER

4) Move split beam mirror holder in, out and around until maximum uniform brightness of image on monitor is achieved.

5) Tighten two set screws and secure split beam mirror holder in optics body.

6) Loosen set screw securing split beam mirror holder to TV light holder.

7) Install TV light holder and four screws to optics body.

8) Tighten set screw and secure split beam mirror holder to TV light holder.

9) Loosen set screw securing camera optics lamp in TV light holder.

10) Move camera optics lamp in, out and around until maximum uniform brightness of image on monitor is achieved.

11) Tighten set screw and secure camera optics lamp in TV light holder.

4.29 LAMPS VOLTAGE LEVEL ADJUSTMENT

1) Set-up for optical adjustments (see task 4.23).

2) Program saw for MODE 815 (see operator manual).

   NOTE: PRESS SINGLE CUT TO INCREASE RIGHT LAMP INTENSITY, AUTO CUT TO DECREASE RIGHT LAMP INTENSITY, ALIGN TO INCREASE LEFT LAMP INTEN-

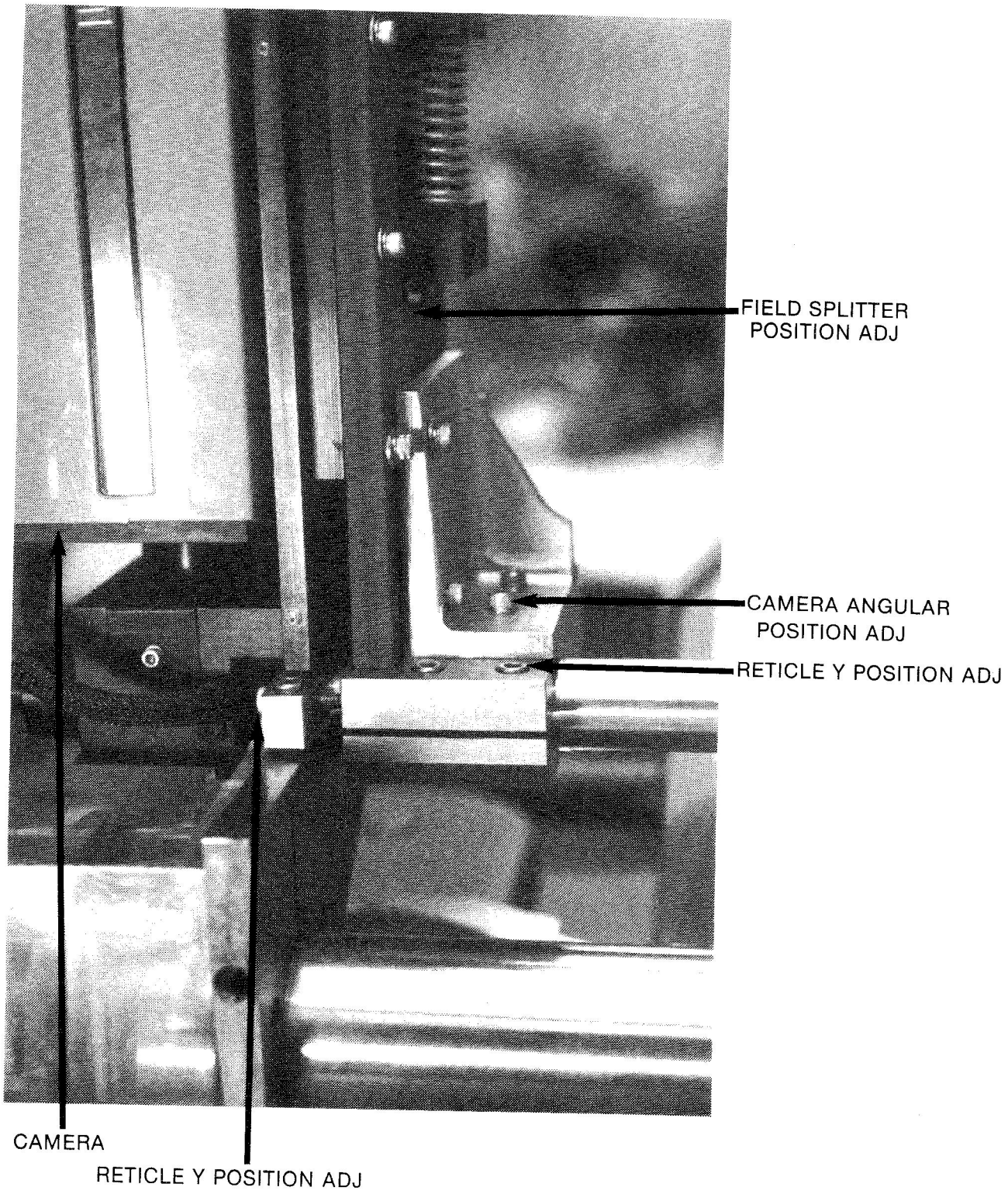


FIGURE 16
REAR OF FOLDED OPTICS CAMERA

SITY AND INDEX TO DECREASE LEFT LAMP INTENSITY.

CAUTION: MAKE SURE YOU ARE IN MODE 815 BEFORE PERFORMING ANY ADJUSTMENTS. FAILURE TO DO SO WILL RESULT IN DESTRUCTION OF TEST WAFER AND BLADE.

3) Adjust lamp intensity for maximum brightness with no blurring of bright spots on wafer.

4) Press CLEAR and check brightness level for character display. If brightness level is too high repeat steps 2-3.

MONITOR CRT ADJUSTMENTS

4.30 For vertical size adjustment:
See figure 15

1) Set-up for optical adjustment (see task 4.23).

2) Remove CRT back panel.

3) Rotate V.SIZE pot on rear of monitor so that edges of picture do not show.

4) Install back panel if adjustment is complete.

4.31 For vertical linearity adjustment:
See figure 15

1) Set-up for optical adjustments (see task 4.23).

2) Remove CRT back panel.

3) Bring checker pattern of micro-mask into view on monitor.

4) Rotate V.LIN pot at rear of monitor so that all squares appear the same vertical size.

5) Install back panel if adjustment is complete.

4.32 For vertical sync adjustment:
See figure 15

1) Set-up for optical adjustment (see task 4.23).

2) Rotate middle pot on monitor heatsink bracket until vertical sync is stable.

4.33 For horizontal sync adjustment:
See figure 15

1) Set-up for optical adjustment (see task 4.23).

2) Rotate top pot on monitor heatsink bracket until horizontal sink is stable.

4.34 For center adjustment:
See figure 15

1) Set-up for optical adjustment (see task 4.23).

2) Remove CRT back panel and cover.

3) Rotate two rings around neck of CRT and bring center of video picture to center of CRT.

FIELD SEPARATION AND CUT ALIGNMENT ADJUSTMENTS

4.35 For reticle Y position alignment adjustment:
See figure 16

1) Set-up for optical adjustments (see task 4.23).

   NOTE: ONCE SINGLE CUT IS MADE, DO NOT MOVE THE CHUCK CW OR CCW UNTIL ADJUSTMENTS ARE COMPLETE.

2) Perform SINGLE CUT operation on test wafer (see operator manual).

3) Loosen two screws securing camera support mount to camera mount.

4) Turn horizontal screw between spindle plate and camera support mount CW or CCW until reticle is centered on cut displayed by monitor.

5) Tighten two screws and secure camera support mount to camera mount.

4.36 For split field position adjustment:
See figure 14

1) Set-up for optical adjustments (see task 4.23).

2) Turn two screws on underside of separator base back and forth until split field separation is centered on monitor.

4.37 For camera angular parallel adjustment:
See figure 14

1) Set-up for optical adjustments (see task 4.23).

2) Move TV optic lever until wafer street lines up across left and right view fields on monitor (parallel to reticle line).

4.38 For field splitter position adjustment:
See figure 14

1) Set-up for optical adjustments (see task 4.23).

2) Loosen set screw on left rear side of camera.

   NOTE: A DARK LINE WILL APPEAR ON MONITOR BETWEEN SPLIT FIELDS THAT OVERLAP. A BRIGHT LINE WILL APPEAR ON MONITOR BETWEEN SPLIT FIELDS TOO FAR APART

3) Turn adjustment screw on right rear side of camera until split fields are adjusted.

4) Tighten set screw on left rear side of camera.

   NOTE: A CONTINUOUS CLEAR THIN LINE SHOULD APPEAR ON MONITOR. ADJUST ANGULAR POSITION OF CAMERA TO CORRECT THIS SYMPTOM.

4.39 For camera angular position adjustment:
See figure 16

1) Set-up for optical adjustments (see task 4.23).

2) Perform a SINGLE CUT operation on a test wafer (see operator manual).

3) Loosen three screws securing camera support to camera support mount.

4) Adjust camera support so that cut is horizontal and lined up with reticle.

5) Tighten three screws making sure that camera support remains in aligned position.

MONOCULAR CAMERA

4.40 FOCUS CAMERA

1) Set-up for optical adjustments (see task 4.23).

2) Turn thumb nut on rear of camera assembly until image on monitor is focused.

4.41 ILLUMINATION ADJUSTMENT

1) Same as folded-optics camera (see task 4.28).

4.42 OBLIQUE ILLUMINATION ADJUSTMENT

1) Set-up for optical adjustments (see task 4.23).

2) Loosen two set screws securing light guide in lamp holder.

3) Adjust light guide until bright spot appears on center of wafer and uniform brightness appears on monitor.

4) Tighten two set screws and secure light guide in lamp holder.

4.43 RETICLE Y POSITION ALIGNMENT

1) Same as folded-optics camera (see task 4.35).

MONOCULAR MICROSCOPE

4.44 FOCUS MICROSCOPE

1) Loosen thumb screw at rear of microscope.

2) Turn thumb nut on microscope and move up or down to focus.

3) Tighten thumb screw at rear of microscope when focus is complete.

4.45 RETICLE Y POSITION ALIGNMENT

1) Same as folded-optics camera (see task 4.35).

4.46 RETICLE ROTATION ADJUSTMENT

1) Set-up for optical adjustments (see task 4.23).

2) Perform SINGLE CUT operation on test wafer.

3) Loosen set screw on right side of eyepiece.

4) Turn outside ring on eyepiece until reticle lines up horizontal with saw cut.

5) Tighten set screw on right side of eyepiece.

4.47 MICROSCOPE ANGULAR POSITION ADJUSTMENT

1) Same as folded optics camera (see task 4.39).

ELECTRICAL

4.48 ADJUST INPUT POWER HOOK-UP

NOTE: CONFIGURE WIRES ACCORDING TO LEFT REAR PANEL VOLTAGE CHART (See drawing #17030940-001, page 7-34).

SECTION 5 (Theory of Operation)

OVERALL CONSTRUCTION
See page 7-6, 7-7

The 1100 saw uses a heavy duty, rib reinforced, multi-level casting as its main support. The casting has four precision ground reference surfaces upon which the Y slide, the X slide, the X lead screw and the Y lead screw are mounted. Two rear panels attach to the casting. All input and output utility connections and four fuse holders are mounted on the rear panels. The spindle power supply is mounted in the right-rear section of the casting. The card cage assembly mounts in the left-rear section.

MECHANICAL ASSEMBLIES

The main mechanical assemblies of the Model 1100 Wafer Dicing Saw are: A spindle assembly, which turns the saw blade, a vacuum chuck, which acts as a carrier for the material to be cut, and four motor driven assemblies, controlling the movements between the saw blade and the chuck. These assemblies are designated X, Y, Z, and theta, referring to the axis along which these assemblies move.

THE SPINDLE ASSEMBLY

The spindle of the 1100 saw is a precision, high-speed, air bearing motor with a shaft designed to accept saw blades. The spindle can turn at controlled speeds between 15,000 and 40,000 rpm. The speed can be adjusted in 100 rpm increments.

An externally supplied water coolant enters the rear of the spindle and circulates through a cooling jacket in the spindle. Cooling water exits out the back of the spindle and out the chassis. Cooling water supply is controlled by a solenoid positioned near the incoming water supply. Solenoid action is controlled by the X-Y driver card and housekeeper CPU on the mother/logic board.

A pressurized air source enters through an air filter and into the rear of the spindle. Air exits around the front of the shaft to protect the motor from water or contamination on the blade end, and through a screened port in the rear. Incoming air pressure is monitored by an air sensor on the mother/logic board. If air pressure drops below 55 PSI, the spindle logic card initiates signals to turn the spindle off and notifies the housekeeper for display of a fault code.

The spindle housing is electrically isolated from the casting by a mylar spacer. A shroud mounted on the front of the spindle holds the rear nozzle housing with its blade cooling nozzles and plexiglass blade cover. Two brushes mounted on the rear of the spindle electrically connect the output shaft to the spindle logic board.

THE X DRIVE MECHANISM
See page 7-7

The X drive involves the X motor, a

flexible coupling, the X leadscrew assembly with matching plastic doublenut, the X drive pin, X mounting plate, leveling roller support, roller support plate, two pillow blocks and a X rail.

X stage motion results from rotation of the X motor caused by voltage generated at the X-Y driver in slot XA7 of the mother/logic board. A flexible coupling clamped to the right end of the X leadscrew and the motor shaft, transfers each rotation of the motor to one for the leadscrew. The right end of the X leadscrew fits snugly through a flanged bearing situated in the X leadscrew support before attaching to the flexible coupling. The left end of the X leadscrew fits snugly into a flanged bearing situated in the left pillow-block.

As the X leadscrew rotates, a matching plastic doublenut travels along the length of the leadscrew. A drive pin connects the X mounting plate to the plastic doublenut transferring movement to the X stage. The X stage mounting plate sits on two pillow blocks which slide on the X rail and a leveling roller support which slides on the roller support plate. Three strategically located jack screws, two on the X mounting plate and one on the roller support plate, allow the X stage mounting plate to be raised or lowered when performing chuck flatness adjustments. The X stage mounting plate carries the theta and Z stages as well.

THE THETA DRIVE MECHANISM
See page 7-25

The theta drive involves the theta worm drive assembly and theta worm wheel assembly.

Theta axis movement results from rotation of the theta motor shaft caused by voltage generated at the Z-theta driver in slot XA8 of the mother/logic board. A spring coupling clamped to the left end of the theta worm shaft and the theta motor shaft, transfers each rotation of the theta motor to one for the theta worm shaft.

Theta worm drive assembly position is adjusted by a screw mounted on the theta worm drive support that can be turned in or out so that the threads on the theta worm gear mesh properly with teeth on the theta worm wheel assembly.

As the theta worm shaft rotates, a worm gear on the shaft also rotates. Rotation of the theta worm gear causes the theta worm wheel to rotate around the Z bearing. A Z ball guide on the vacuum chuck assembly fits into the Z guide block on the theta worm wheel assembly and transfers rotational movement of the theta worm wheel into rotational movement of the vacuum chuck assembly.

THE Z DRIVE MECHANISM
See page 7-27

The Z drive involves the Z motor, a flexible coupling, the Z leadscrew and nut, and the Z bearing assembly.

Z axis movement results from rotation of the Z motor shaft caused by voltage generated at the theta-Z driver in slot XA8 of the mother/logic board. A flexible coupling clamped to one end of the Z leadscrew and the Z motor shaft, transfers each rotation of the motor to one for the Z leadscrew.

A Z leadscrew nut lodges inside the Z nut housing. As the Z leadscrew rotates through the Z leadscrew nut, the Z leadscrew nut travels up or down the Z leadscrew causing the Z nut housing and vacuum chuck assembly to raise up or down with it. The Z nut housing slides up and down through a ball cage situated inside the Z bearing around which the theta worm wheel rotates.

THE Y DRIVE MECHANISM
See page 7-29

The Y drive involves the Y motor, a flexible coupling, the Y leadscrew with doublenut, a ball holder, the Y slide flag holder, and the Y slide.

Y axis movement results from rotation of the Y motor shaft caused by voltage generated at the X-Y driver motor in slot XA7 of the mother/logic board. A flexible coupling clamped to the rear end of the Y leadscrew and Y motor shaft, transfers each rotation of the Y motor to one for the Y leadscrew.

The rear end of the Y leadscrew fits snugly through a flanged bearing situated in the Y leadscrew support before attaching to the flexible coupling. The forward end of the Y leadscrew fits snugly into a flanged bearing situated in the Y leadscrew front support block. A Y leadscrew bellows is inflated around the Y leadscrew by incoming air at the Y leadscrew support and Y leadscrew front support block. The bellows keeps electro-statically charged dust from collecting on the Y leadscrew.

As the Y leadscrew rotates, a doublenut with ball holder travels along the length of the Y leadscrew. Connected to the doublenut and ball holder is the Y slide flag holder. The Y slide flag holder connects to the Y slide and transfers the linear motion of the Y leadscrew doublenut and ball holder to the Y slide.

Each step of the Y motor results in 0.0001" movement of the blade.

STEPPING MOTORS

There are four stepping motor assemblies in the Model 1100 saw. They are identified as X,Y,Z, and theta. The Z motor has no motor sensor and is not interchangeable with the other motors. The X, Y, and theta motor assemblies are identical. They are connected to their mechanical assemblies by flexible couplings and are easily interchangeable.

All motors are connected to a motor PCB on top of the motor. Flat ribbon cables connect the motor PCB to the mother/logic board. One of two motor driver cards (C7 or C8) in the card cage generates pulsed signals to turn the stepper motor. One of two motor CPUs (C2 or C3) in the card cage controls the operation of the motor driver card. The housekeeper CPU initi-

ates programmed instructions to the motor CPU to operate a motor driver card for a set of motor movements.

Movement of The X-Y-theta motors are monitored by sensors attached to the motor PCBs. On one end of the X-Y-theta motors is an encoder disk marked with 200 discrete light and dark strips. As the motor turns, the encoder disk turns, passing through a light sensor that can detect each change of light. A square wave output is generated by the motor PCB and serves as a source of feedback to motor CPU cards.

During high speed operation, the motor CPU waits for feedback from the motor PCB that a step has been made before it will generate another step. This closed loop operation of the stepper motor is used to assure that each step has time to be properly made. During slow speed, open loop operation, there is no performance feedback. Z motor operation is always open loop since there is no encoder disk on the Z motor assembly to provide feedback.

The X-Y-theta assemblies have balance and alignment adjustments that can be made. These two adjustments are performed in conjunction with each other and are measured by internal diagnostics built into the saw. The balance adjustment moves the encoder disk so that each light or dark strip is in phase with the discrete steps of the stepper motor. The alignment adjustment uses a potentiometer on the motor PCB to equate the velocity of the motors movement for both directions of rotation. These adjustments cannot be made on the Z motor.

LIMIT SENSOR CIRCUITS
See pages 7-45 through 7-48

Limit sensor circuits provide feedback to the motor CPUs indicating the travel limits of the X, Y, Z and theta stages. The X, Y and theta axis each have two limit sensors which are mounted on a single PCB. The Z axis has a single lower limit sensor. Upper limit for the Z axis is determined during the chuck zero sequence. Limit sensor PCBs remain fixed relative to movement of the axis being monitored.

Flags mounted to each axis are adjusted to interrupt a light sensor when the limit of travel for that axis is reached. Interruption of the light sensor causes a signal to be transmitted from the limit sensor PCB to the motor CPU. Ribbon cables attach each limit sensor board to jack J12 and J13 on the mother/logic board.

During homing, chuck zero and normal operation, the motor CPU causes the motor to back the flag out of the limit sensor after the flag enters the limit sensor.

Limit sensor input to the motor CPU is analysed and cross checked with information about motor movement and axis position. If motor movement contradicts expectation of a mechanical limit being sensed, a fault code is displayed on the program panel by the housekeeper.

The sensor boards are mounted by screws through permanent standoffs. The position and design of these standoffs is carefully controlled to provide automatic alignment when a

sensor board is replaced. Test pins are provided on each sensor card for failure analysis and maintenance.

ELECTRICAL ASSEMBLIES
See pages 7-34, 7-35 and 7-37

The electrical assemblies of the 1100 saw consist of the AC power input circuitry, two mother boards, a control and program
panel, nine plug-in PC boards holding the logic and control circuitry and associated harnesses.

POWER INPUT CIRCUITRY
See page 7-34

The Model 1100 saw operates on single phase, 50/60 HZ input power. The power supply can be adjusted for any voltage by jumping terminals on TB1. Six nominal input voltages are available: 100V, 112V, 125V, 200V, 225V, and 250V.

The input power cord has three wires. The ground wire ties directly to the saw chassis. The hot wire and the neutral wire connect to two sets of fuses on the rear panel, through a top cover actuated safety switch. The safety switch disconnects all power to the saw by interrupting both the hot line and the neutral line when the top cover is removed. A service position is provided to bypass the safety switch by, centering the switch plunger and then pulling the switch plunger up until it locks. In addition, the hot wire is controlled by the ON/OFF mushroom switch on the front panel.

After the two switches, raw input power travels through anti-surge circuits, line filters and fuses before reaching TB1. From TB1, power is distributed to transformers T1 and T2.

Output of the secondary windings supplies the following voltages to the power supply mother board:

Logic circuits - 8.5 VAC at 6A

Stepping motors, high voltage - 60 VAC at 6A

Stepping motors, low voltage - 10 VAC at 15A

Solenoids - 14 VAC at 5A

Monitor - 17 VAC at 2A

Analog - 17.5 VAC at 1.5A

Spindle motor - 135 VAC at 8A

Lights - 7.5 VAC at 3A

Spindle control - 12 VAC at 1A

POWER SUPPLY MOTHER BOARD
See page 7-35

The power supply mother board is the main distribution point for power to the rest of the saw. The power supply mother board receives power from transformer T1 at jack J3 and from transformer T2 at jack J7. The power to logic/mother board harness distributes power from jack P1 on the power supply mother board to jack J25 on the logic/mother board. The computer spindle interface harness connects jack J25 on the power supply motherboard to jack J11 on the logic/mother board.

Jack J2 on the power supply mother board distributes power to the spindle motor through the spindle w/connector harness. Jack J6 on the power supply mother board distributes power to the lights.

Relay K1 on the power supply mother board controls voltage distribution to the spindle through jack J2. The spindle drive board mounts horizontally and the spindle controller board mounts vertically on the power supply mother board. A fuse bank of 14 fuses is situated on one side of the power supply mother board.

A primary function of the power supply mother board is to convert AC power to DC. Circuits on the power supply motherboard convert AC input power to +60 VDC high voltage for the stepper motors, +10 VDC low voltage for the stepper motors, +14 VDC for the solenoids, and +8 VDC for the card cage.

LOGIC MOTHER BOARD
See page 7-37

The logic mother board is located in the bottom of the card cage assembly. The following PC boards plug into the logic mother board: housekeeper (XA1), X-theta CPU (XA2), Y-Z CPU (XA3), video generator (XA5), spindle logic (XA6), X-Y driver (XA7), and theta-Z driver (XA8).

The logic mother board contains the following connections:

Front panel connector (J9)

Local bus connector (J10)

Spindle interface connector (J11)

X and Y axis connector (J12)

Theta and Z axis connector (J13)

Water manifold connector (J14)

Air/vacuum manifold connector (J15)

Camera connector (J16)

Auxiliary connector (J17)

Monitor connector (J18)

External single pin connectors (J19-J23)

Camera video connector (J24)

Power input connector (J25)

Spindle temperature sensor connector (J26)

Spindle brush connector (J27)

The logic mother board also contains the reset/power fail circuitry.

Reset circuitry provides a reset pulse to the housekeeper when supply voltage reaches a certain point during power on sequence. Reset circuitry also provides a signal when voltages drop below a level where components can operate properly.

During reset, all computer cards are initialized. That is, any values not stored in nonvolatile program memory will be lost. This includes values established during chuck zero sequence. During reset, all front panel indicator lights flicker and the four

mechanical axis go through a homing sequence.

The power fail signal goes to the housekeeper, X-theta CPU and Y-Z CPU. This signal indicates to these boards that there are three milliseconds to store useful information into a non-volatile CMOS memory before power loss.

A vacuum sensor (U3), air pressure sensor (U4), and associated circuitry are also located on the mother/logic board. The two sensors are mechanically identical. The vacuum sensor is connected in a direction opposite of the air sensor, giving a positive voltage for negative air pressure, that is vacuum. The sensors are initially set at the factory and generally will require no further adjustment. However, four potentiometers; vac offset, vac gain, air offset, and air gain, are available on the mother/logic board should an adjustment need to be made.

Three main bus lines connect various components on the mother/logic board with other components both on and off the mother/logic board. The card cage bus connects all the cards in the card cage and enables them to talk with one another. The front panel bus allows the housekeeper to communicate with the control panel and program panel through jack J9. A local bus connects the housekeeper with auxiliary hookups at jack J10.

Four DIP switches (SW2-SW5) on the mother/logic board work in conjunction with the two motor CPU boards. Y linearity correction (SW3) and Z offset correction (SW2) interface with the Y-Z motor CPU. Z offset correction is not used at this time. Y linearity switch settings are displayed by the monitor during Y linearity adjustment. One DIP switch (SW4) connected to the X-theta CPU is as yet uncommitted. The other (SW5) connected to the X-theta CPU is used to determine Eng/Met units, Scr/Dice cutting mode and the use of Microeye I or Microeye II auxiliary devices.

HOUSEKEEPER CPU
See page 7-53

The housekeeper CPU is situated in slot XA1 of the logic motherboard. It communicates with the control and program panels through the front panel bus and mother/logic board jack J9. It communicates with the X-theta CPU, Y-Z CPU, video generator card, and spindle logic card via the card cage bus on the mother/logic board. A local bus connects the housekeeper CPU to auxiliary hookups through mother/logic board jack J10. The housekeeper CPU controls action of the solenoids via signals to the X-Y and theta-Z driver cards. The housekeeper CPU monitors the activities of components through the communication busses and issues high level commands to control the integration of system function.

The hardware of the housekeeper CPU is identical with the X-theta CPU and the Y-Z CPU. The only difference between cards is the software programming that exists on five 32K EPROM chips. Each of these first three cards in the card cage also consists of an enhanced 8 bit processing unit, a process decoder, a 2K RAM chip, two 1K CMOS RAM chips, three 16 bit programmable

timers, three peripheral interface adapters (PIA) and a 5V regulator.

The card CPU is a 6809 8 bit processing unit with 16 bit registers and operations.

The process decoder is basically an address decoder with eight outputs used by the CPU to select a chip.

The 2K RAM chip is used as temporary storage for values generated by the EPROM programs during saw operation.

The two 1K CMOS RAM chips are battery backed and serve as stores of nonvolatile memory for programs and data you may input. CMOS memory is initiated by power fail/reset circuitry on the mother/logic board.

The three PIAs serve as input and output ports between the circuit card and the rest of the system.

Timer #1 on the housekeeper generates a 10 millisecond square wave to keep track of events for itself and for other cards. Timer #2 is used for auxiliary timing functions and is flexible in its applications. Timer #3 controls the frequency, ie., tone of the annunciator speaker.

The main processing unit is connected to a 4 mega HZ crystal clock control. Pin E and pin Q at the top end of the main processing unit have an external operating frequency of 1 mega hz. Pin Q is offset 1/4 phase from pin E.

X-THETA CPU
See page 7-53

NOTE: THE HARDWARE CONFIGURATION OF THE X-THETA CPU IS THE SAME AS THE HOUSEKEEPER CPU. SEE HOUSEKEEPER FOR DESCRIPTION OF THE BASIC HARDWARE

The X-theta CPU is located in slot XA2 on the logic/motherboard. The X-theta CPU is interchangeable with the Y-Z CPU, the only differences being the way they are addressed by the housekeeper and the program that may be stored in nonvolatile memory.

The X-theta CPU receives speed and distance commands from the housekeeper CPU. It then issues signals to the X-Y driver card and theta-Z driver card to drive the X and theta motors. The X-theta CPU receives limit sensor input and step sensor input and issues execution complete signals to the housekeeper if correct feedback is obtained. The X-theta CPU will automatically stop the motor if a limit sensor is hit prematurely. The X-theta CPU will report erroneous feedback to the housekeeper board where a fault code message will be initiated to the program panel.

The X-theta CPU also receives input from two switching banks. One is uncommitted at this time and the other enables selection of Eng/Met units, Scr/Dice cutting mode and Microeye I or Microeye II auxiliary devices. Settings for this DIP switch is marked next to the switch, on the mother/logic board.

The two CMOS RAM chips on the X-theta CPU have nothing to do with operation

of the X and theta motors. They serve only as extensions of housekeeper memory. As a result, when replacing the X-theta CPU, memory stored in the X-theta CPU CMOS RAM will be lost.

Two of the timers on the X-theta CPU control high voltage signals to the two motor driver cards. The third timer sets time segments between steps of the motor.

Y-Z CPU
See page 7-53

NOTE: THE HARDWARE CONFIGURATION OF THE Y-Z CPU IS THE SAME AS THE HOUSEKEEPER CPU. SEE HOUSEKEEPER FOR DESCRIPTION OF THE BASIC HARDWARE

The Y-Z CPU is located in slot XA3 on the logic/motherboard. The Y-Z CPU is interchangeable with the X-theta CPU, the only difference being the way they are addressed by the housekeeper and the program that may be stored in non-volatile memory.

The Y-Z CPU receives speed and distance commands from the housekeeper CPU. It then issues signals to the X-Y driver card and theta-Z driver card to drive the Y and Z motors.

The Y-Z CPU receives limit sensor input and step sensor input for the Y axis only, and issues an execution complete to the housekeeper if correct feedback is obtained. The Y-Z CPU will stop the motor if a limit sensor is hit prematurely. The Y-Z CPU will report erroneous feedback to the housekeeper board where a fault code message will be initiated to the program panel.

The Y-Z CPU also receives input from two banks of eight DIP switches. The first bank of DIP switches is for Y linearity correction and the second bank is for Z offset correction. The setting for the Y linearity DIP switch is displayed on the monitor during the Y linearity adjustment. The Z offset correction is not being used at this time.

The two CMOS RAM chips on the Y-Z CPU have nothing to do with operation of the Y and Z motors. They serve only as extensions of housekeeper memory. As a result, when replacing the Y-Z CPU, memory stored in the Y-Z CPU CMOS RAM will be lost.

Two of the timers on the X-theta CPU control high voltage signals to the two motor driver cards. The third timer sets time segments between steps of the motor.

X-Y DUAL DRIVER BOARD
See page 7-56

The X-Y driver board is located in slot XA7 of the mother/logic board. The X-Y driver board receives all its signals for driving the X and Y stepper motors from the X-theta CPU and Y-Z CPU. It then generates the voltages required to operate the stepper motors. It also receives signals from the housekeeper CPU to control the air/vac manifold solenoids.

THETA-Z DUAL DRIVER BOARD
See page 7-56

The theta-Z driver board is located in slot XA8 of the mother/logic board. The theta-Z driver board receives all its signals for driving the theta and Z stepper motors from the X-theta CPU and Y-Z CPU. It then generates voltages in the power levels required to operate the stepper motors. It also receives signals from the housekeeper CPU to control the water solenoids and sensor.

VIDEO GENERATOR BOARD
See page 7-55

The video generator board is located in slot XA5 of the mother/logic board. The video generator has both analog and digital logic circuitry. It has a basic computing section similar to the housekeeper CPU and the two motor CPUs. It receives instructions from the housekeeper CPU for display of characters and error messages during program mode.

The video generator has a reticle and character generator. Four reticle colors: 1) white, 2) black, 3) dashed W/B and 4) white/video can be used for camera video display unless a view system reticle is being used.

Finally, the video generator functions as a relay station for video to and from the View System Box, video to auto align andvideo to monitor. The video generator also relays horizontal and vertical sync signals generated from the View System Box or video generator to the monitor and camera.

The video generator receives input from the camera via jack J16 on the mother/logic board. The video generator interfaces with the View System Box for Microeye I or Microeye II through jacks J18-J23 on mother/logic board. Jack J18 on the mother/logic board carries signals from the video generator to the monitor.

SPINDLE LOGIC CPU
See page 7-57

The spindle logic CPU is located in slot XA6 of the mother/logic board. Its primary function is to generate the signals that set the speed and voltage of the spindle. It also contains the chuck zero circuitry, an analog to digital converter for measurement of vacuum and air sensor voltage levels and for measurement of 60V and 10V stepper motor supply levels. The spindle logic CPU contains disable and brake circuitry for the spindle and it controls the voltage for lighting the high and low LEDs on back of the power input panel. It converts digital to analog voltage for the camera lamps.

The spindle logic board is directed by speed commands issued from the housekeeper. Speed and voltage commands from the spindle logic CPU are output as two variable frequency signals to the spindle controller. Each rpm of the spindle equates to ten times as many HZ output at pin 20. Signal frequencies output at pin 22 go to the spindle controller where they are converted to a voltage, compared with required voltage and adjusted until proper voltage is achieved.

The spindle logic card outputs 150 VDC to the spindle brushes when it re-

ceives instructions from the housekeeper to perform a chuck zero sequence. When an arc occurs between the blade and chuck, it is detected by the spindle logic board where a detection circuit operates and relays information to the theta-Z CPU board that a chuck zero was obtained. Relay K1 on the spindle logic card is used during simulation of a chuck zero to test and align the chuck zero detection circuit on the spindle logic board.

Analog voltages from the air and vacuum sensors on the mother/logic board, are converted to digital voltages and sent to the housekeeper to be displayed and checked against acceptable values. Air pressure out of range will cause the spindle logic card to initiate a spindle shut down and cause the housekeeper to initiate a fault code. 60V and 10V power supplies are also converted by the spindle logic board and values sent to the housekeeper.

Disable output is from pin 21 and brake output is from pin 46. LED high signals leave at pin 23 and LED low signals leave at pin 24.

SPINDLE CONTROLLER
See page 7-58

The spindle controller is located in slot J4 of the power supply mother board. Its main two functions are to translate variable frequency inputs from the spindle logic board into voltage and phase commands to the spindle drive board. It also transfers spindle brake and disable commands to the spindle drive board.

A secondary function of the spindle controller is to convert ±17.5 VAC analog to ±20 VDC analog for the monitor and video generator.

SPINDLE DRIVE BOARD
See page 7-54

The spindle drive board lies in a horizontal position and connects with the power supply mother board at jack J8. Six power transistors supply all the power to drive the spindle windings. It receives all its signals from the spindle controller to supply voltages to the spindle windings through relay K1 and jack J2.

VACUUM CHUCK ASSEMBLY
See page 7-20

The vacuum chuck assembly consists of a top chuck and base chuck, a bellows, Z ball guide with theta spring, Z flag mount with flag and a barbed fitting.

The top chuck fits on top of the base chuck and carries a wafer during the cutting process. A tube installed to a barbed fitting on the underside of the base chuck carries vacuum pressure causing the wafer to be sucked down on the top chuck when the WAFER LOCK switch is pressed. The same tube also carries air pressure which is activated when the WAFER RELEASE switch is pressed. Concentric grooves cut into the top chuck transfers vacuum and air pressure to the surface of the wafer.

The base chuck screws on top of the Z nut housing and moves up and down

along with Z stage movement. The Z flag attaches to the Z flag mount on the underside of the base chuck and interrupts the Z lower limit sensor on the theta worm wheel when the Z lower limit is reached. The vacuum chuck bellows prevents contamination from reaching the Z bearing assembly.

A Z ball guide attached to the bottom of the base chuck, fits into the Z guide block on the theta worm wheel assembly and transfers rotational movement of the theta worm wheel to the top chuck assembly. The entire vacuum chuck assembly is carried along with the Z stage for X stage movement.

AIR/VACUUM/WATER
See page 7-14

Cutting water enters the saw through a water pressure sensor that detects water pressure less than the required amount to operate the saw. Cutting water passes through various fittings at the rear pneumatics panel, through solenoid #9 and to two points at the rear nozzle housing. Solenoid #9 is activated during cutting of the wafer or the WATER TEST. The rear nozzle housing channels the cutting water to the two spray nozzles and the tangential spray nozzle.

Air pressure enters the saw through fittings on the rear pneumatics panel where one branch goes to the air-/vacuum manifold. From the air vacuum manifold, air goes out valve #1 through a restrictor to the Y leadscrew bellows and to the camera where it splits to blow water off the wafer under each lens. Air pressure exits the air/vacuum manifold through valve #2 and goes to the camera to keep the lenses dry. Air pressure to release the wafer exits the air/vacuum manifold, goes through the air regulator and splices into the vacuum tube before going to the vacuum chuck. Solenoid #4 turns off the WAFER RELEASE air pressure when the WAFER LOCK vacuum is activated. Air pressure is released into the cooling water fittings when solenoid #5 is activated to purge the spindle of cooling water after operation.

Air that does not branch off to the air/vacuum manifold, passes through a micron filter and goes to either the spindle to supply the air bearings or to the air pressure sensor on the mother/logic board. A fault code is initiated and the spindle shut down if the air pressure falls below a critical value.

Vacuum pressure enters the saw through fittings at the rear pneumatics panel and goes to the air/vacuum manifold. From there a vacuum tube goes to the mother/logic board vacuum sensor where a fault code is initiated if the vacuum falls below a critical value. Solenoid #1 on the air/vacuum manifold controls the release of vacuum pressure to the vacuum chuck when the WAFER LOCK switch is activated. Solenoid #2 on the air/vacuum manifold controls the release of vacuum pressure to the blade removal tool when the BLADE TOOL switch is activated.

SECTION 6 (Troubleshooting)

FAULT CODE INDEX

Code	Definition	Action
F201	Chuck zero ciruit is open.	See page 6-4
F202	Chuck zero circuit is shorted.	See page 6-5
F214	No vacuum	See page 6-7
F215	No cutting water pressure	See page 6-9
F216	Air pressure low or missing	See page 6-12
F220	X left limit hit	See page 6-13
F221	X right limit hit	See page 6-15
F222	Y rear limit hit	See page 6-17
F223	Y forward limit hit	See page 6-19
F224	Theta CCW limit hit	See page 6-21
F225	Theta CW limit hit	See page 6-23
F226	Z down limit hit	See page 6-25
F230	X left sensor not detected	See page 6-27
F232	Y rear sensor not detected	See page 6-28
F234	Theta CCW sensor not detected	See page 6-30

Code	Definition	Action
F240	X left sensor still detected	See page 6-32
F242	Y rear sensor still detected	See page 6-33
F244	Theta CCW sensor still detected	See page 6-34
F246	Z down sensor still detected	See page 6-35
F250	Input voltage out of range	See page 6-36
F301	Card 1 failure, press ENTER	Follow display instruction
F302	Card 2 failure, press ENTER	Follow display instruction
F303	Card 3 failure, press ENTER	Follow display instruction
F304	Card 4 failure, press ENTER	Follow display instruction
F305	Card 5 failure, press ENTER	Follow display instruction
F306	Card 6 failure, press ENTER	Follow display instruction
F307	Card 7 failure, press ENTER	Follow display instruction
F308	Card 8 failure, press ENTER	Follow display instruction

Code	Fault	Action
F310	EPROM checksum failed, press ENTER	Follow display instruction
F311	RAM check failed, press ENTER	Follow display instruction
F322	Card 2 missing	Replace card 2.
F323	Card 3 missing	Replace card 3.
F325	Card 4 missing	Replace card 4.
F326	Card 5 missing	Replace card 5.
F327	Card 6 missing	Replace card 6.
F330	CMOS checksum failed, press ENTER	Follow display instruction
F332	10 volt supply out of range	See page 6-39
F333	60 volt supply out of range	See page 6-39
	Call key operator	Notify supervisor

FAULT CODE FOLLOW-ON TESTING

F201 - CHUCK ZERO CIRCUIT IS OPEN

This fault code indicates that the output of the chuck zero circuit failed to switch to 5V when the CPU sent a test command to energize relay K1 on the spindle logic board.

To isolate the fault:

NOTE: CONTINUE WITH FAULT ISOLATION PROCEDURE UNTIL A FAULT IS FOUND. CHECK TO SEE THAT REPAIR ACTIONS STOP DISPLAY OF FAULT CODE. ALWAYS INSTALL REMOVED PARTS BEFORE COMPLETING TASK.

1) Turn spindle off.
2) Remove two wires from insulated brush holder on rear of spindle.
3) Measure resistance between brushes.
4) IS BRUSH RESISTANCE LESS THAN 1K OHM?

YES

NO

1) Clean brushes, brush contacts, and extend brush springs.

1) Install two wires on insulated brush holder and make sure both wires are securely attached to brushes.
2) Check wire connection at jack J27 on mother/logic board motherboard.
3) IS CONNECTION OK?

YES

NO

1) Replace bad wire with connector or mother/logic board (see task 3.58).

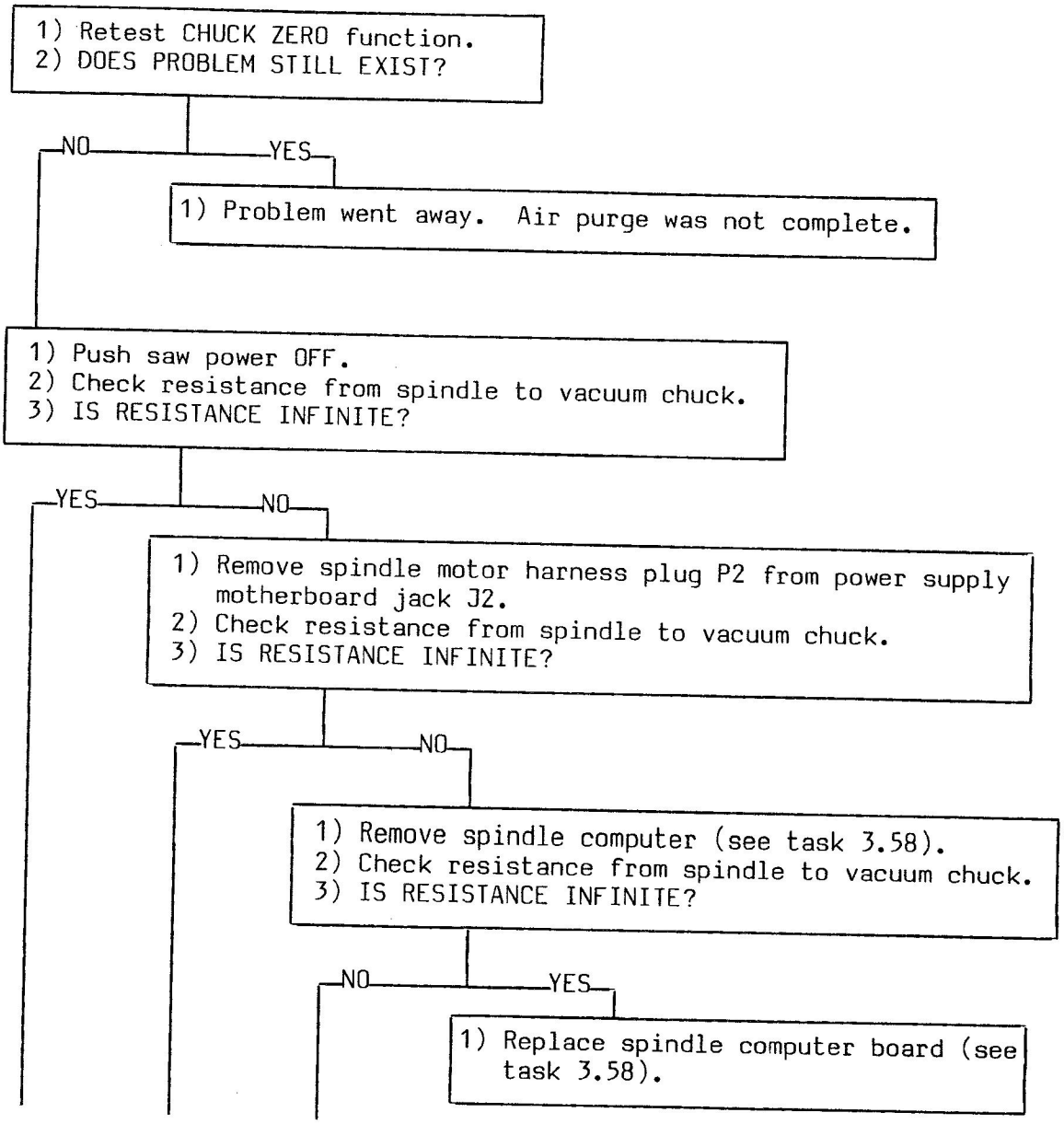
1) Replace spindle computer board (see task 3.58).

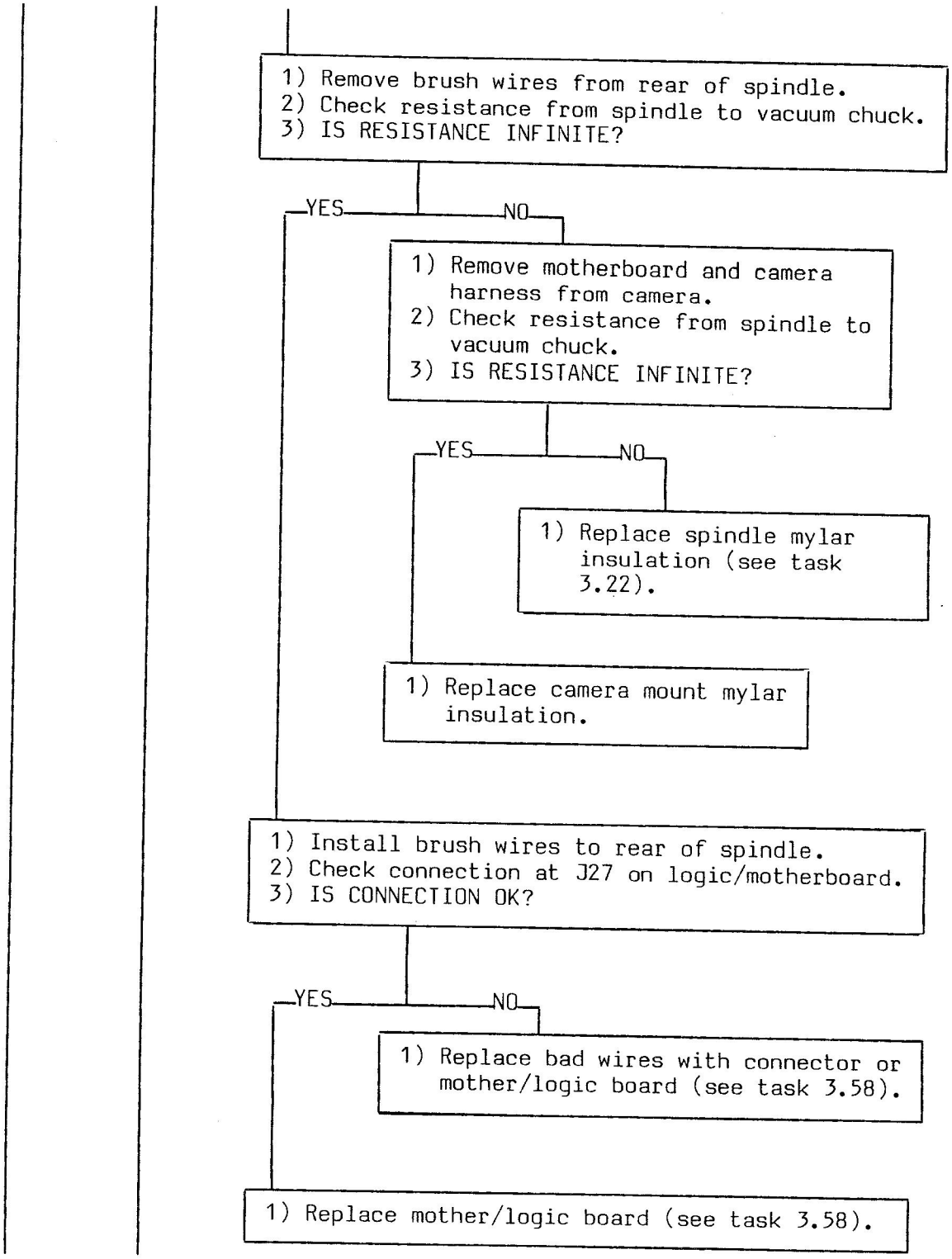
F202 - CHUCK ZERO CIRCUIT IS SHORTED

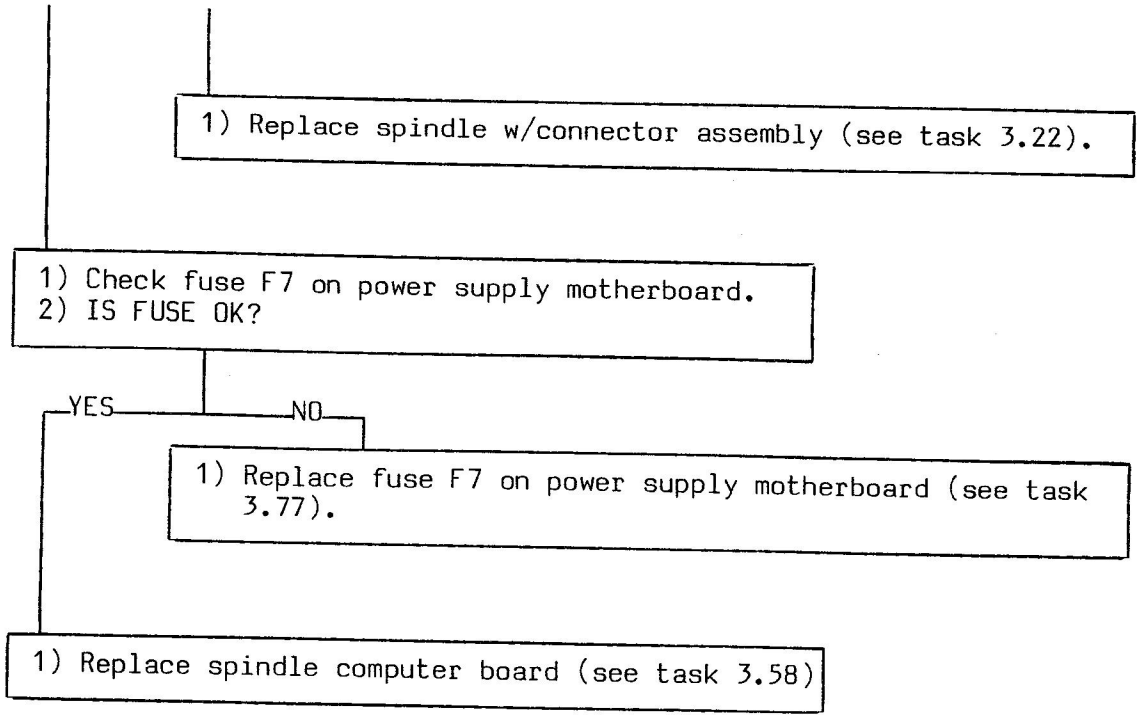
This fault code indicates that the output of the chuck zero circuit failed to switch to zero volts when the CPU sent a test command to de-energize relay K1 on the spindle logic board.

To isolate the fault:

NOTE: CONTINUE WITH FAULT ISOLATION PROCEDURE UNTIL A FAULT IS FOUND. CHECK TO SEE THAT REPAIR ACTIONS STOP DISPLAY OF FAULT CODE. ALWAYS INSTALL REMOVED PARTS BEFORE COMPLETING TASK.




1) Remove brush wires from rear of spindle.
2) Check resistance from spindle to vacuum chuck.
3) IS RESISTANCE INFINITE?
YES
NO
1) Remove motherboard and camera harness from camera.
2) Check resistance from spindle to vacuum chuck.
3) IS RESISTANCE INFINITE?
YES
NO
1) Replace spindle mylar insulation (see task 3.22).
1) Replace camera mount mylar insulation.
1) Install brush wires to rear of spindle.
2) Check connection at J27 on logic/motherboard.
3) IS CONNECTION OK?
YES
NO
1) Replace bad wires with connector or mother/logic board (see task 3.58).
1) Replace mother/logic board (see task 3.58).



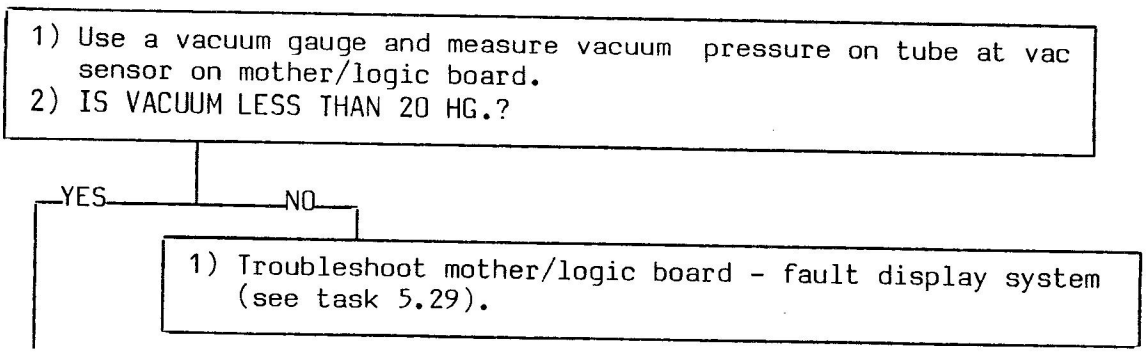
F214 - NO VACUUM

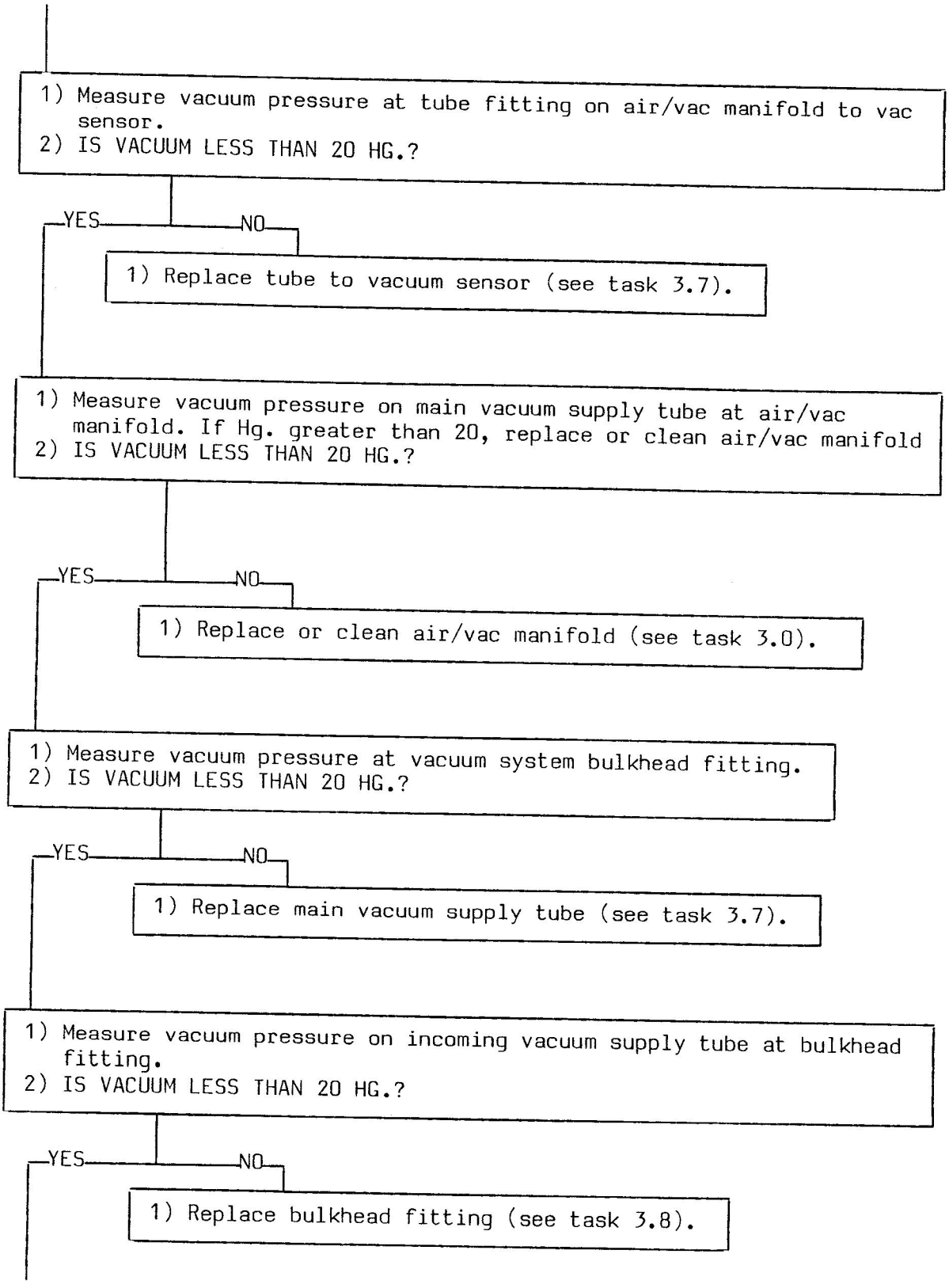
This fault code indicates that the housekeeper CPU has received a OV signal from the vacuum sensor switch.

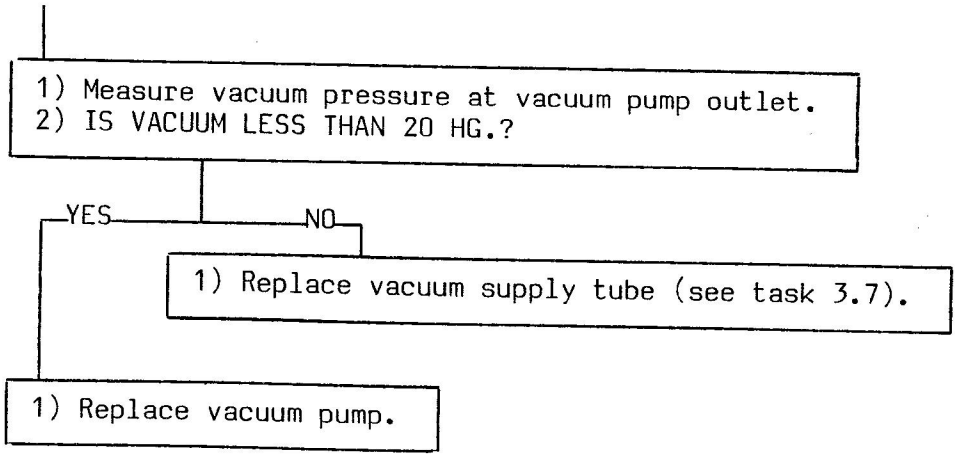
To isolate the fault:

NOTE: CONTINUE WITH FAULT ISOLATION PROCEDURE UNTIL A FAULT IS FOUND. CHECK TO SEE THAT REPAIR ACTIONS STOP DISPLAY OF FAULT CODE. ALWAYS INSTALL REMOVED PARTS BEFORE COMPLETING TASK.

NOTE: WAFER LOCK AND BLADE TOOL SWITCHES SHOULD BE OFF.




1) Measure vacuum pressure at tube fitting on air/vac manifold to vac sensor.
2) IS VACUUM LESS THAN 20 HG.?
YES
NO
1) Replace tube to vacuum sensor (see task 3.7).
1) Measure vacuum pressure on main vacuum supply tube at air/vac manifold. If Hg. greater than 20, replace or clean air/vac manifold
2) IS VACUUM LESS THAN 20 HG.?
YES
NO
1) Replace or clean air/vac manifold (see task 3.0).
1) Measure vacuum pressure at vacuum system bulkhead fitting.
2) IS VACUUM LESS THAN 20 HG.?
YES
NO
1) Replace main vacuum supply tube (see task 3.7).
1) Measure vacuum pressure on incoming vacuum supply tube at bulkhead fitting.
2) IS VACUUM LESS THAN 20 HG.?
YES
NO
1) Replace bulkhead fitting (see task 3.8).

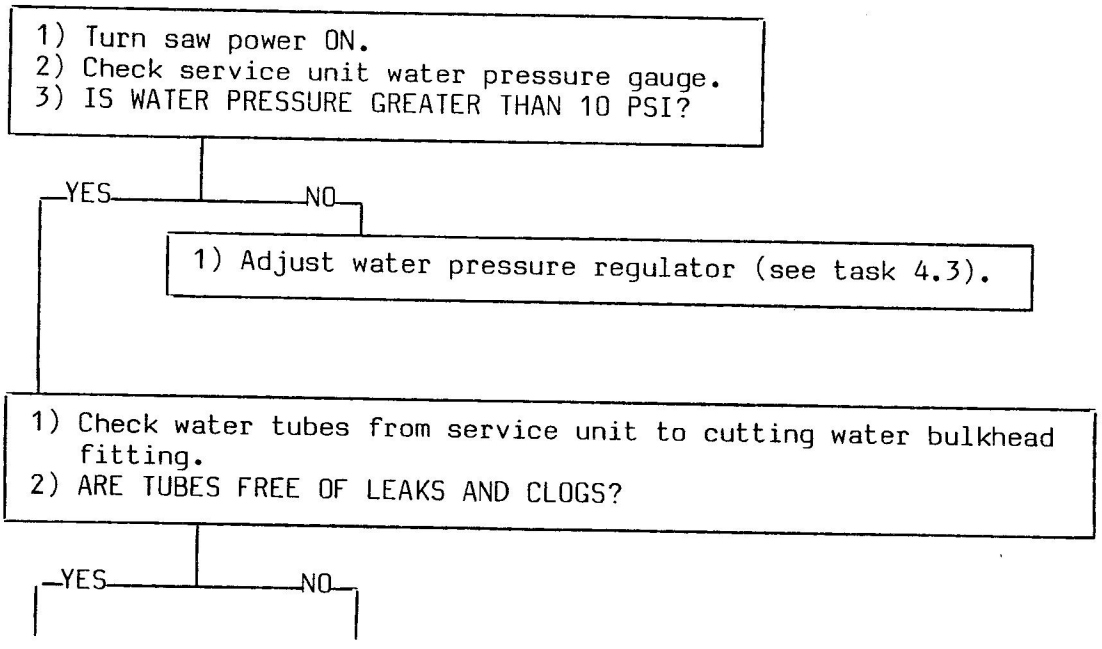


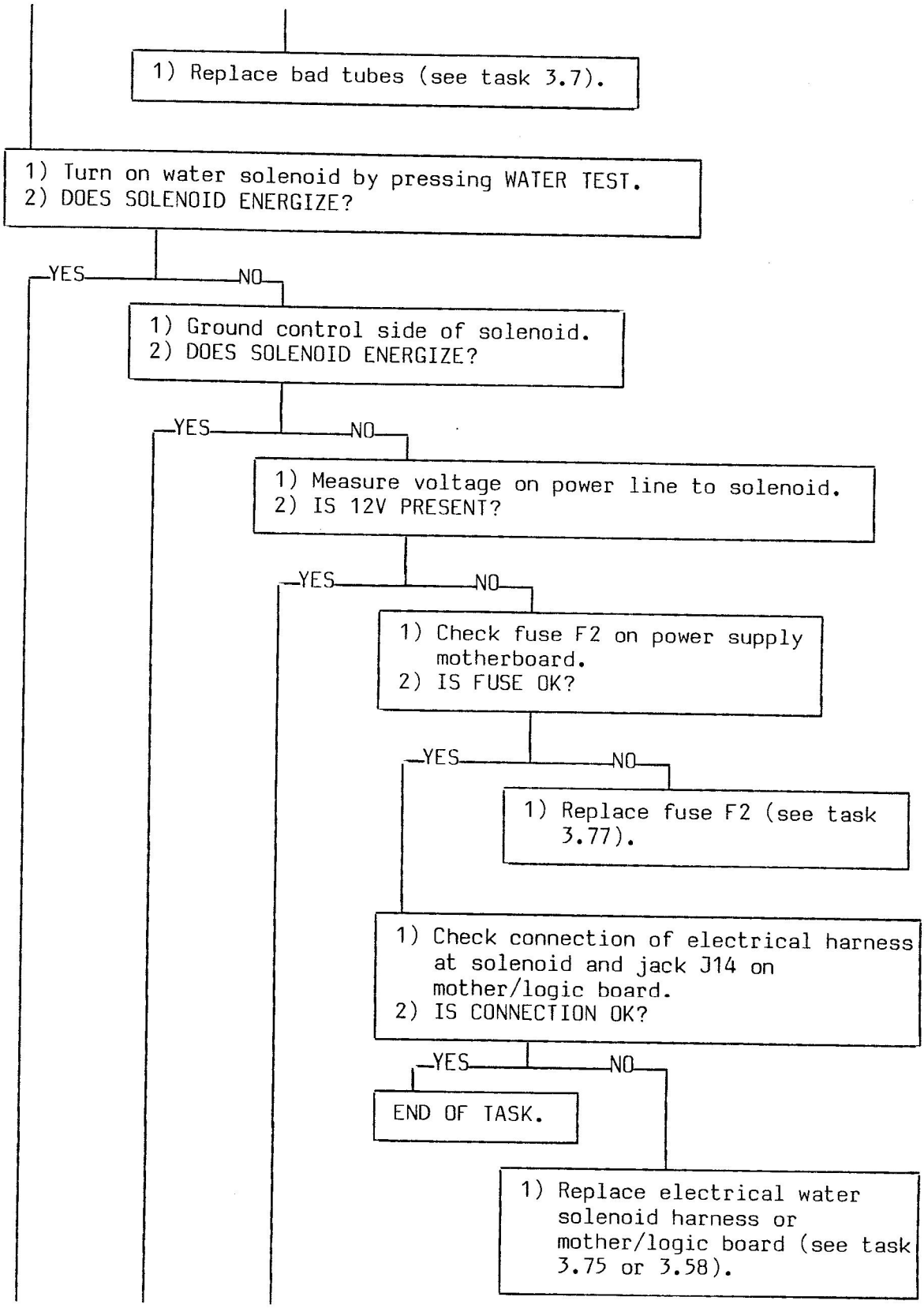
F215 - NO CUTTING WATER PRESSURE

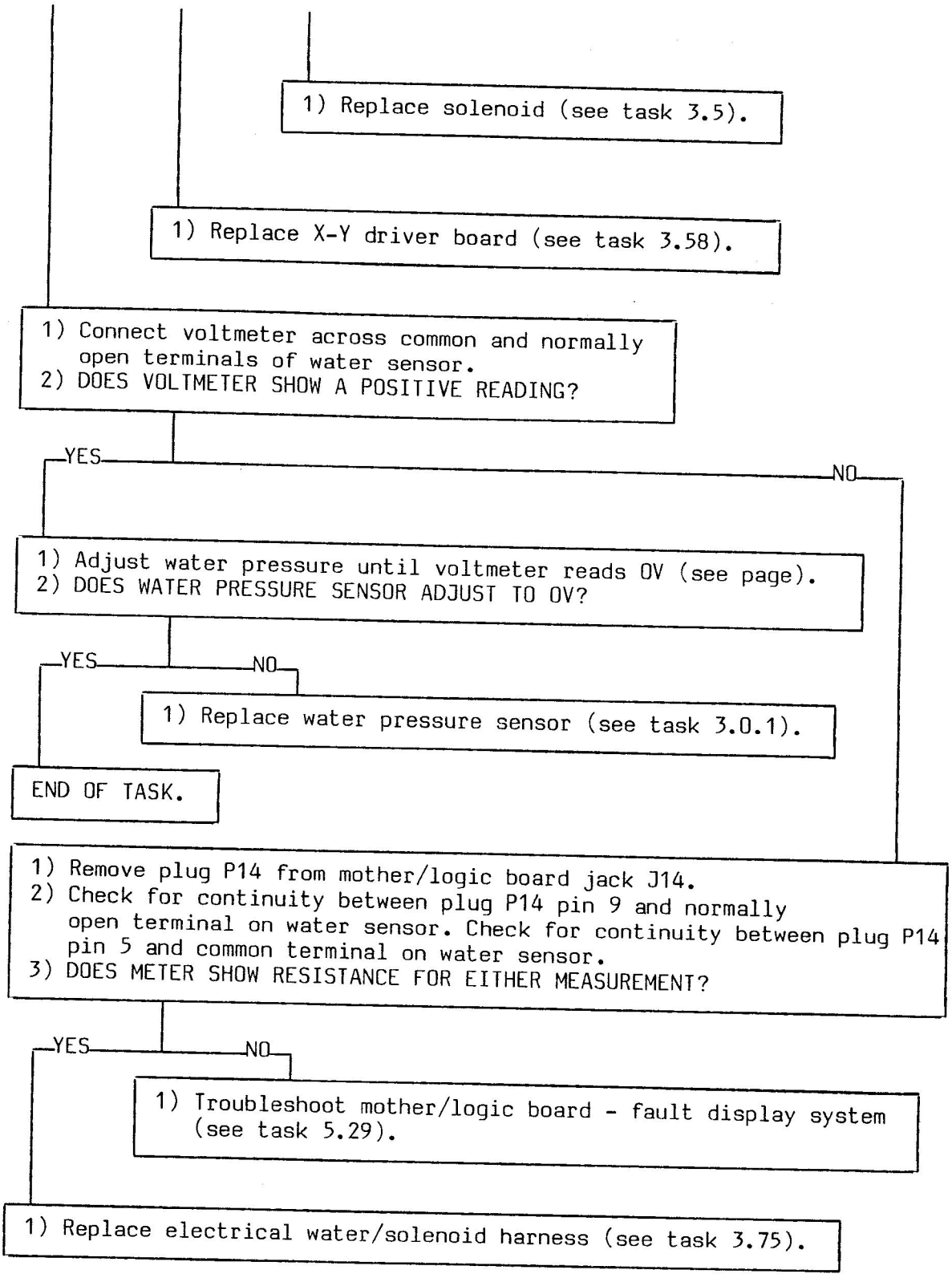
This fault code indicates that the housekeeper CPU has received a 5V signal from the cutting water sensor switch. This switch will open when cutting water pressure is less than 10 PSI.

To isolate the fault:

NOTE: CONTINUE WITH FAULT ISOLATION PROCEDURE UNTIL A FAULT IS FOUND. CHECK TO SEE THAT REPAIR ACTIONS STOP DISPLAY OF FAULT CODE. ALWAYS INSTALL REMOVED PARTS BEFORE COMPLETING TASK.




1) Replace bad tubes (see task 3.7).
1) Turn on water solenoid by pressing WATER TEST.
2) DOES SOLENOID ENERGIZE?
YES
NO
1) Ground control side of solenoid.
2) DOES SOLENOID ENERGIZE?
YES
NO
1) Measure voltage on power line to solenoid.
2) IS 12V PRESENT?
YES
NO
1) Check fuse F2 on power supply motherboard.
2) IS FUSE OK?
YES
NO
1) Replace fuse F2 (see task 3.77).
1) Check connection of electrical harness at solenoid and jack J14 on mother/logic board.
2) IS CONNECTION OK?
YES
NO
END OF TASK.
1) Replace electrical water solenoid harness or mother/logic board (see task 3.75 or 3.58).

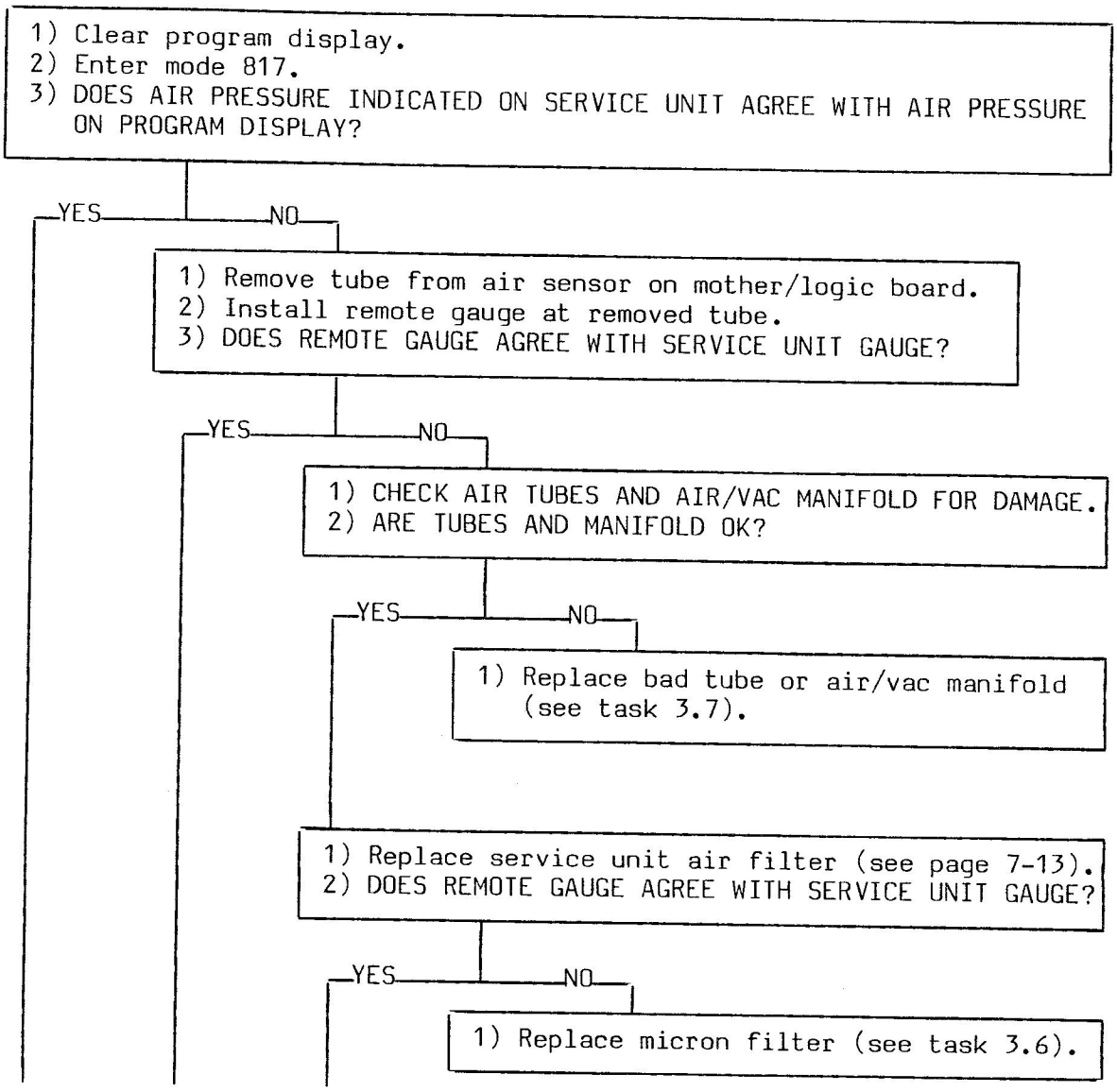

1) Replace solenoid (see task 3.5).
1) Replace X-Y driver board (see task 3.58).
1) Connect voltmeter across common and normally open terminals of water sensor.
2) DOES VOLTMETER SHOW A POSITIVE READING?
YES
NO
1) Adjust water pressure until voltmeter reads OV (see page).
2) DOES WATER PRESSURE SENSOR ADJUST TO OV?
YES
NO
1) Replace water pressure sensor (see task 3.0.1).
END OF TASK.
1) Remove plug P14 from mother/logic board jack J14.
2) Check for continuity between plug P14 pin 9 and normally open terminal on water sensor. Check for continuity between plug P14 pin 5 and common terminal on water sensor.
3) DOES METER SHOW RESISTANCE FOR EITHER MEASUREMENT?
YES
NO
1) Troubleshoot mother/logic board - fault display system (see task 5.29).
1) Replace electrical water/solenoid harness (see task 3.75).

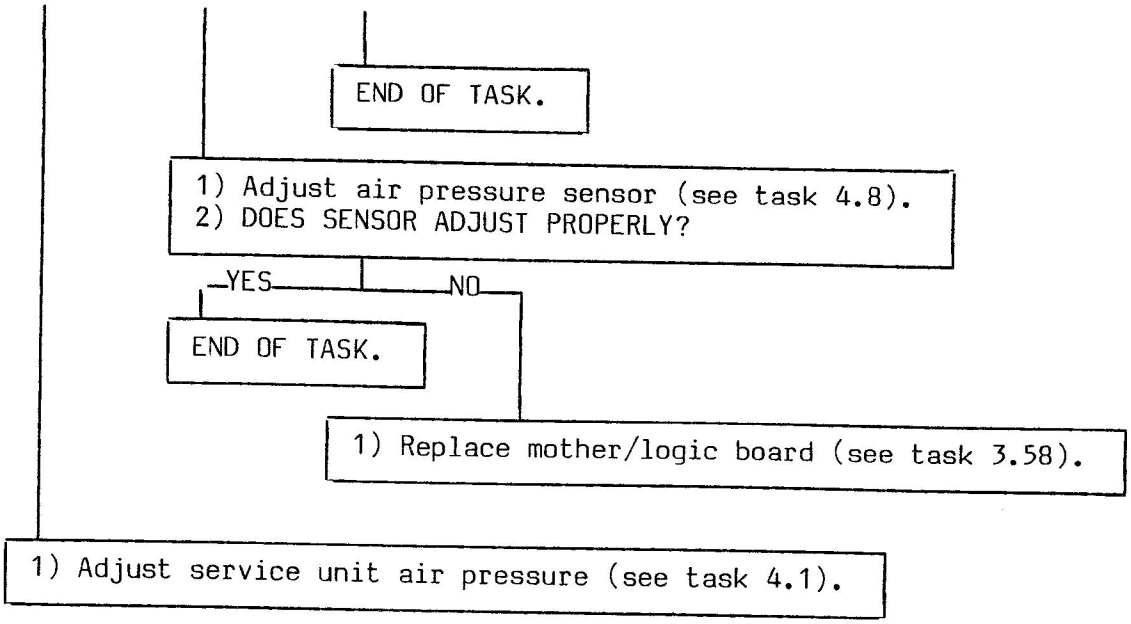
F216 - AIR PRESSURE LOW OR MISSING

This fault code indicates that the housekeeper CPU has received a 0V signal from the air sensor switch.

To isolate the fault:

NOTE: CONTINUE WITH FAULT ISOLATION PROCEDURE UNTIL A FAULT IS FOUND. CHECK TO SEE THAT REPAIR ACTIONS STOP DISPLAY OF FAULT CODE. ALWAYS INSTALL REMOVED PARTS BEFORE COMPLETING TASK.



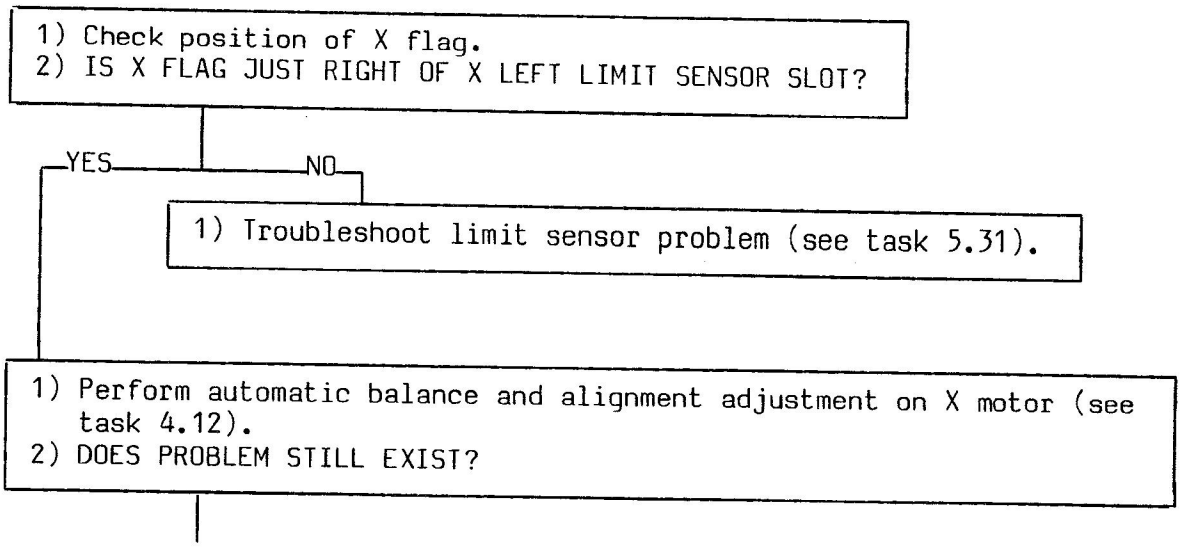


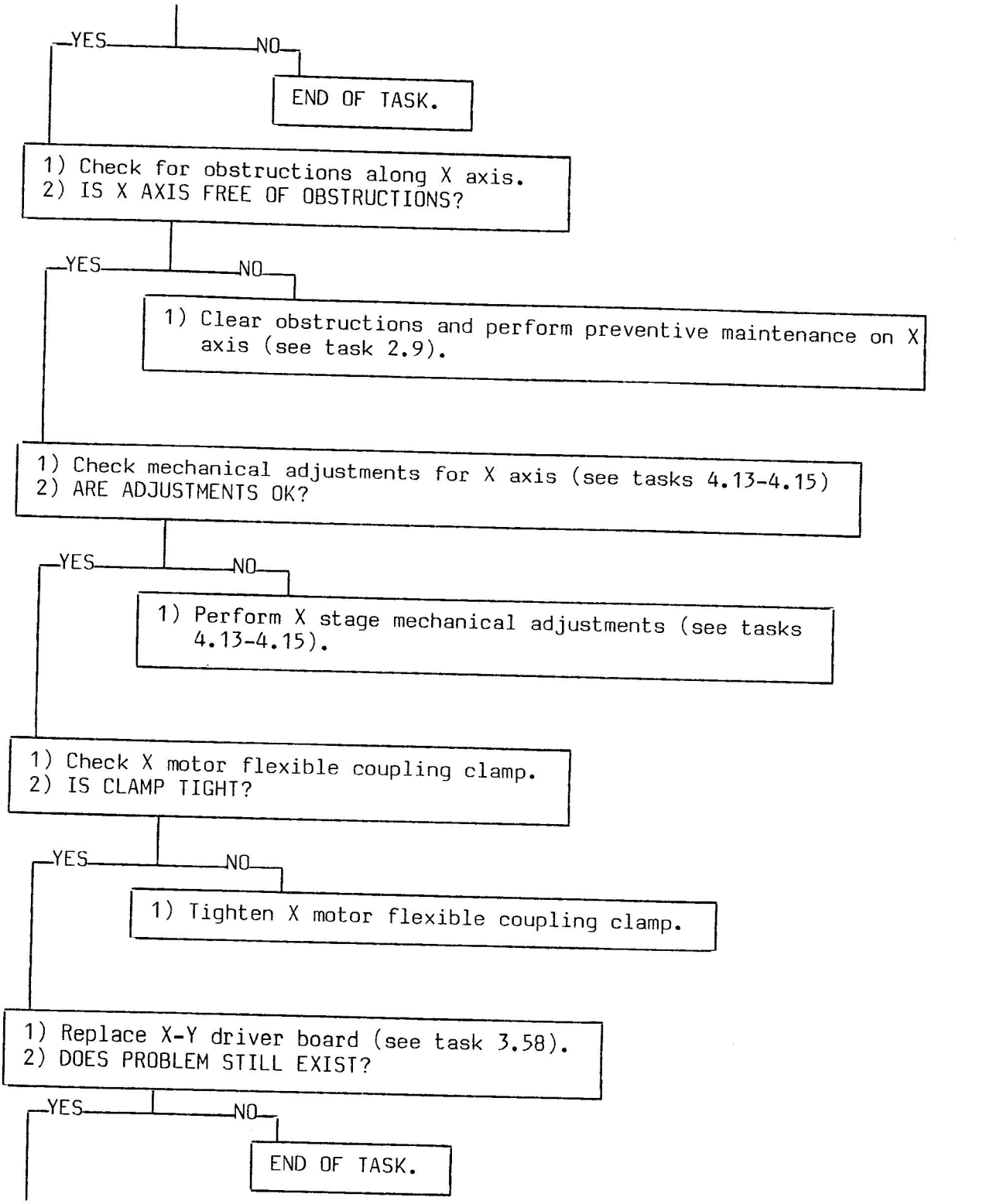
F220 - X LEFT LIMIT HIT

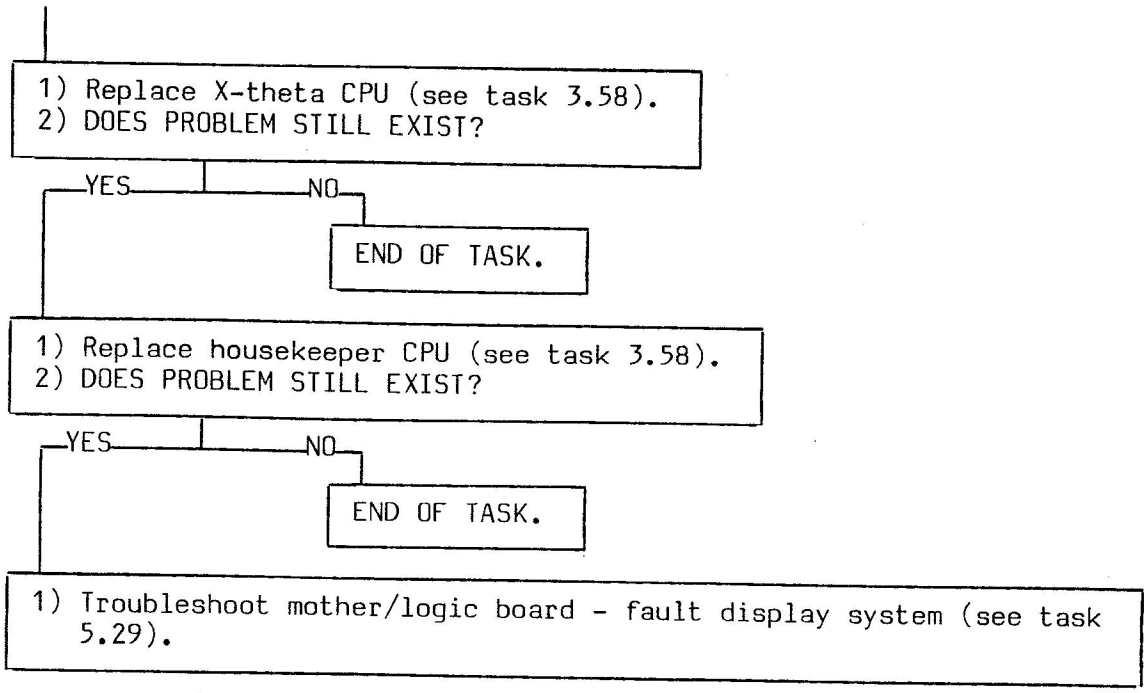
This fault indicates that the CPU has detected a 0 volt signal from the X left limit sensor when the X stage should not be at the left limit.

To isolate the fault:

NOTE: CONTINUE WITH FAULT ISOLATION PROCEDURE UNTIL A FAULT IS FOUND. CHECK TO SEE THAT REPAIR ACTIONS STOP DISPLAY OF FAULT CODE. ALWAYS INSTALL REMOVED PARTS BEFORE COMPLETING TASK.




YES
NO
END OF TASK.
1) Check for obstructions along X axis.
2) IS X AXIS FREE OF OBSTRUCTIONS?
YES
NO
1) Clear obstructions and perform preventive maintenance on X axis (see task 2.9).
1) Check mechanical adjustments for X axis (see tasks 4.13-4.15)
2) ARE ADJUSTMENTS OK?
YES
NO
1) Perform X stage mechanical adjustments (see tasks 4.13-4.15).
1) Check X motor flexible coupling clamp.
2) IS CLAMP TIGHT?
YES
NO
1) Tighten X motor flexible coupling clamp.
1) Replace X-Y driver board (see task 3.58).
2) DOES PROBLEM STILL EXIST?
YES
NO
END OF TASK.

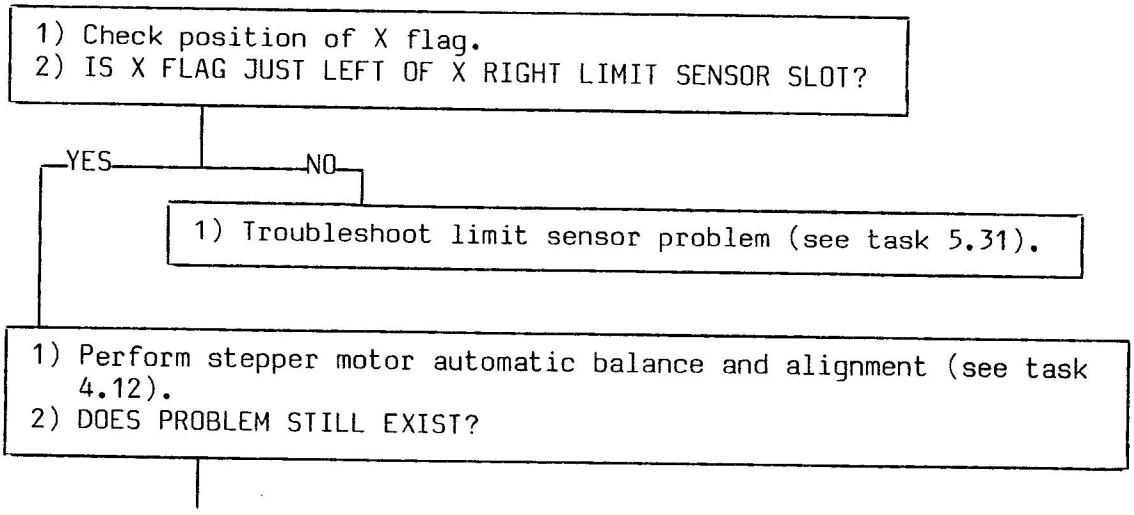


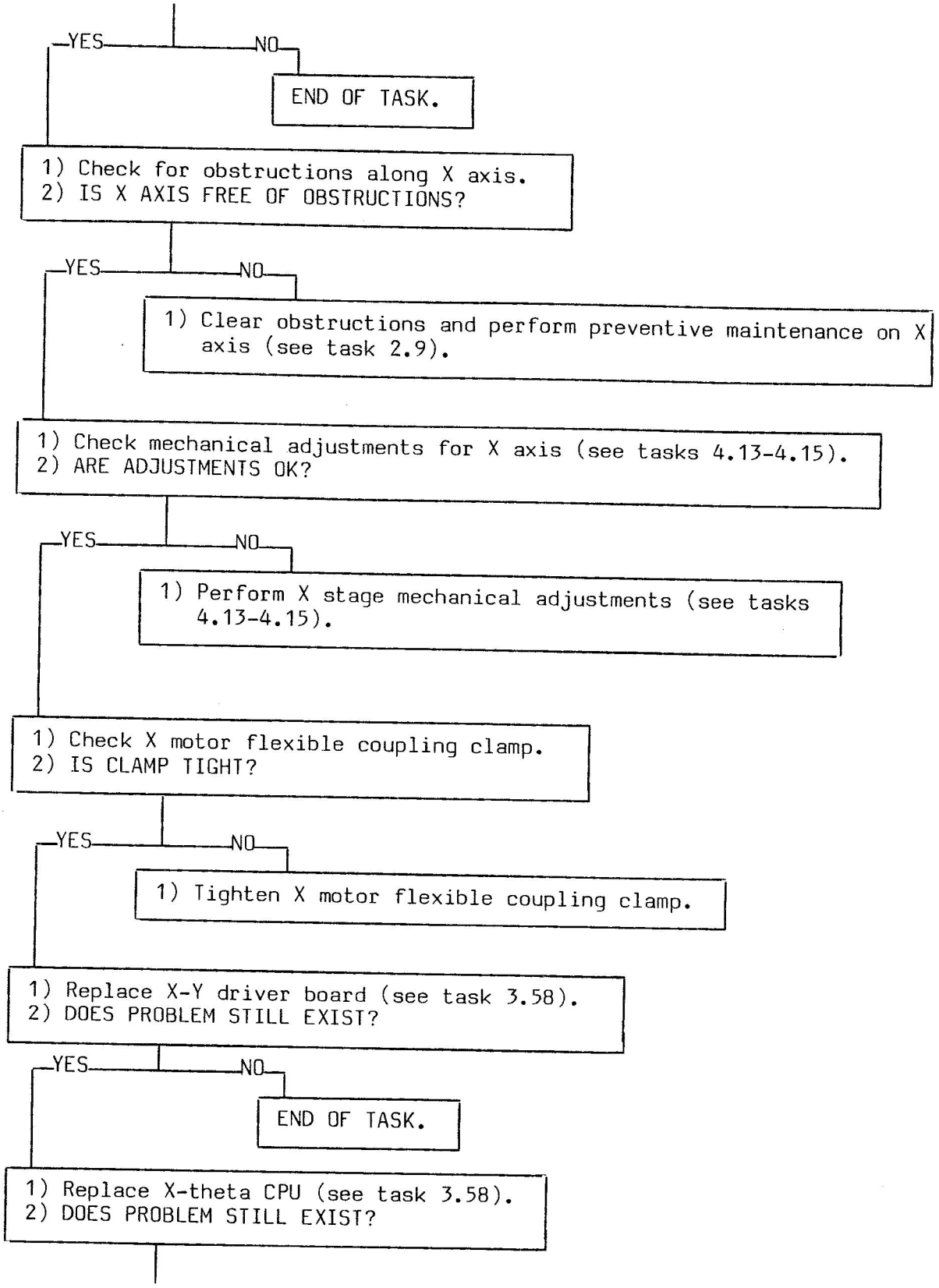
F221 - X RIGHT LIMIT HIT

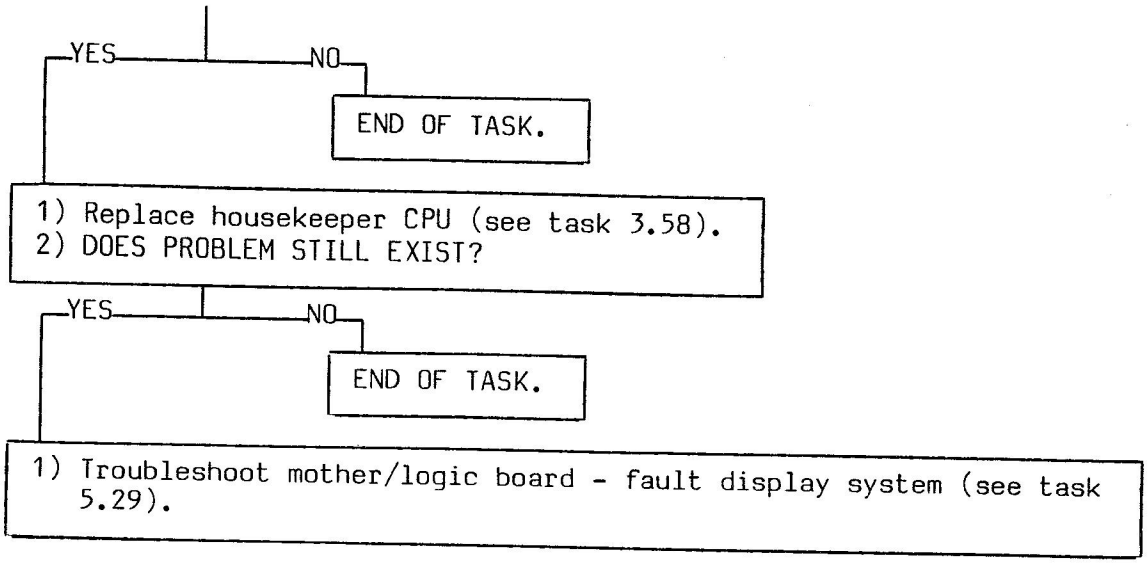
This fault indicates that the CPU has detected a 0 volt signal from the X right limit sensor when the X stage should not be at the right limit.

To isolate the fault:

> NOTE: CONTINUE WITH FAULT ISOLATION PROCEDURE UNTIL A FAULT IS FOUND. CHECK TO SEE THAT REPAIR ACTIONS STOP DISPLAY OF FAULT CODE. ALWAYS INSTALL REMOVED PARTS BEFORE COMPLETING TASK.




YES
NO
END OF TASK.
1) Check for obstructions along X axis.
2) IS X AXIS FREE OF OBSTRUCTIONS?
YES
NO
1) Clear obstructions and perform preventive maintenance on X axis (see task 2.9).
1) Check mechanical adjustments for X axis (see tasks 4.13-4.15).
2) ARE ADJUSTMENTS OK?
YES
NO
1) Perform X stage mechanical adjustments (see tasks 4.13-4.15).
1) Check X motor flexible coupling clamp.
2) IS CLAMP TIGHT?
YES
NO
1) Tighten X motor flexible coupling clamp.
1) Replace X-Y driver board (see task 3.58).
2) DOES PROBLEM STILL EXIST?
YES
NO
END OF TASK.
1) Replace X-theta CPU (see task 3.58).
2) DOES PROBLEM STILL EXIST?

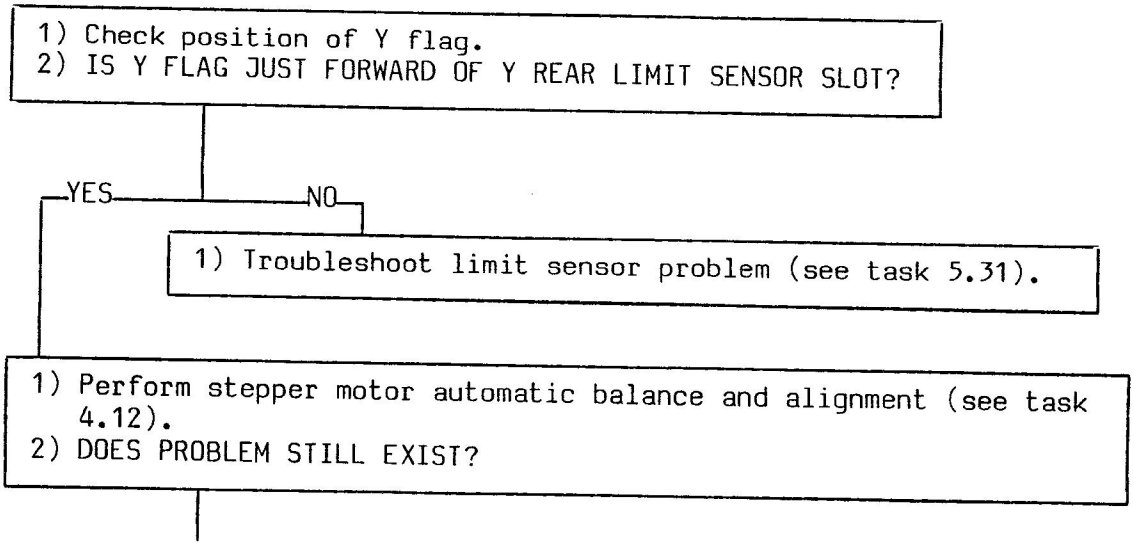


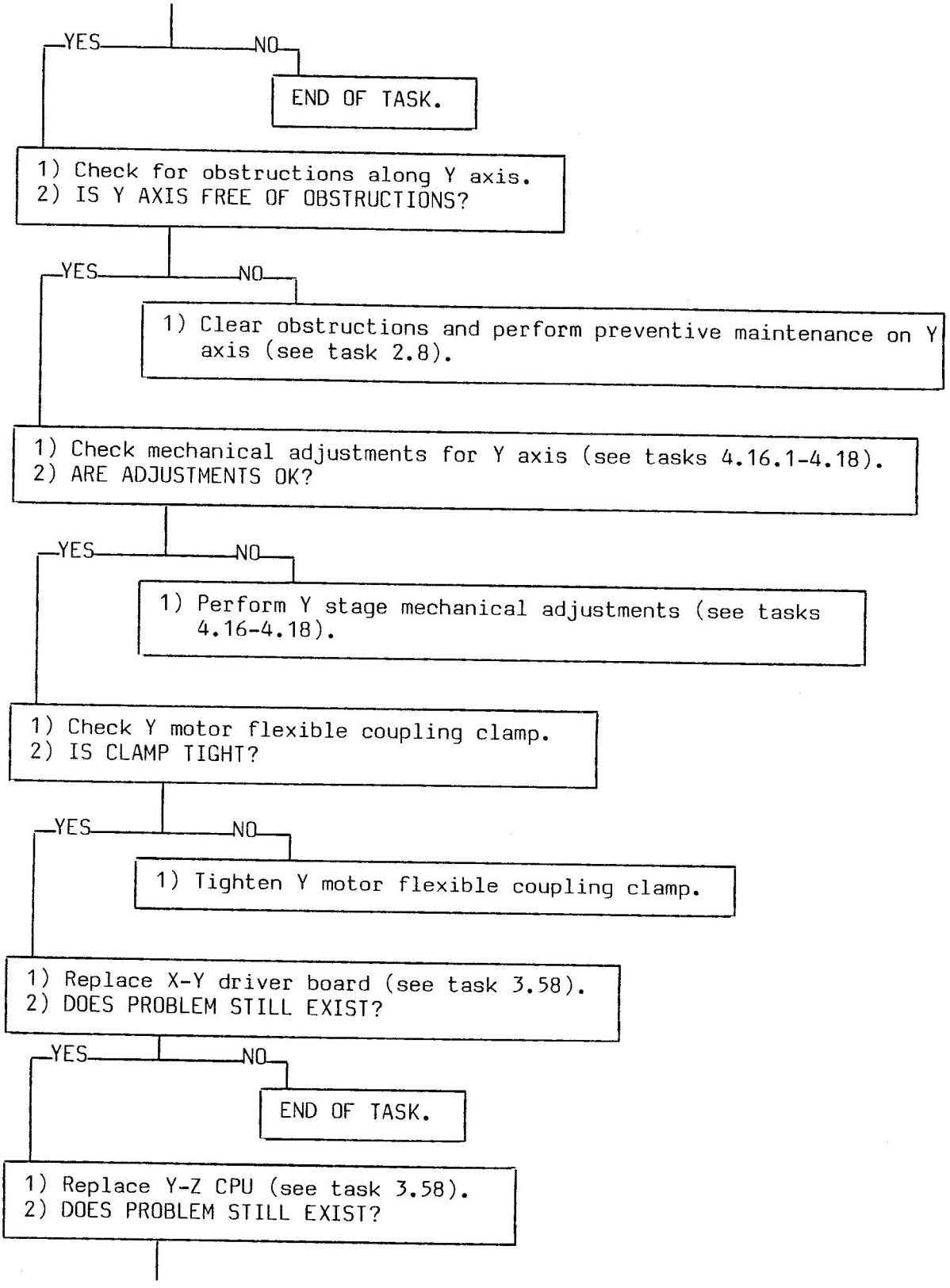
F222 - Y REAR LIMIT HIT

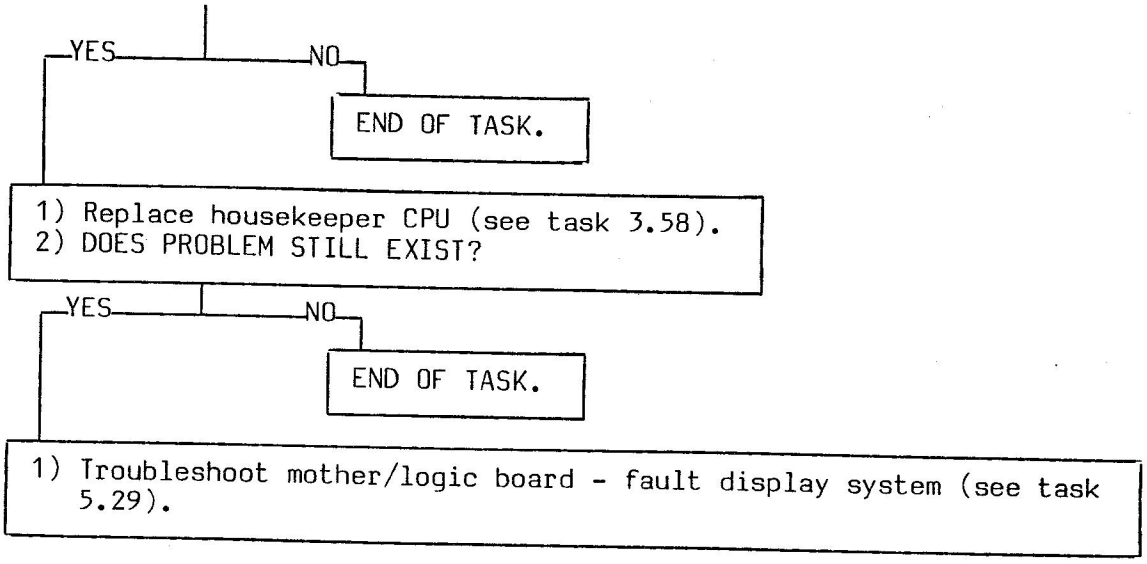
This fault indicates that the CPU has detected a 0 volt signal from the Y rear limit sensor when the Y stage should not be at the rear limit.

To isolate the fault:

NOTE: CONTINUE WITH FAULT ISOLATION PROCEDURE UNTIL A FAULT IS FOUND. CHECK TO SEE THAT REPAIR ACTIONS STOP DISPLAY OF FAULT CODE. ALWAYS INSTALL REMOVED PARTS BEFORE COMPLETING TASK.




YES
NO
END OF TASK.
1) Check for obstructions along Y axis.
2) IS Y AXIS FREE OF OBSTRUCTIONS?
YES
NO
1) Clear obstructions and perform preventive maintenance on Y axis (see task 2.8).
1) Check mechanical adjustments for Y axis (see tasks 4.16.1-4.18).
2) ARE ADJUSTMENTS OK?
YES
NO
1) Perform Y stage mechanical adjustments (see tasks 4.16-4.18).
1) Check Y motor flexible coupling clamp.
2) IS CLAMP TIGHT?
YES
NO
1) Tighten Y motor flexible coupling clamp.
1) Replace X-Y driver board (see task 3.58).
2) DOES PROBLEM STILL EXIST?
YES
NO
END OF TASK.
1) Replace Y-Z CPU (see task 3.58).
2) DOES PROBLEM STILL EXIST?

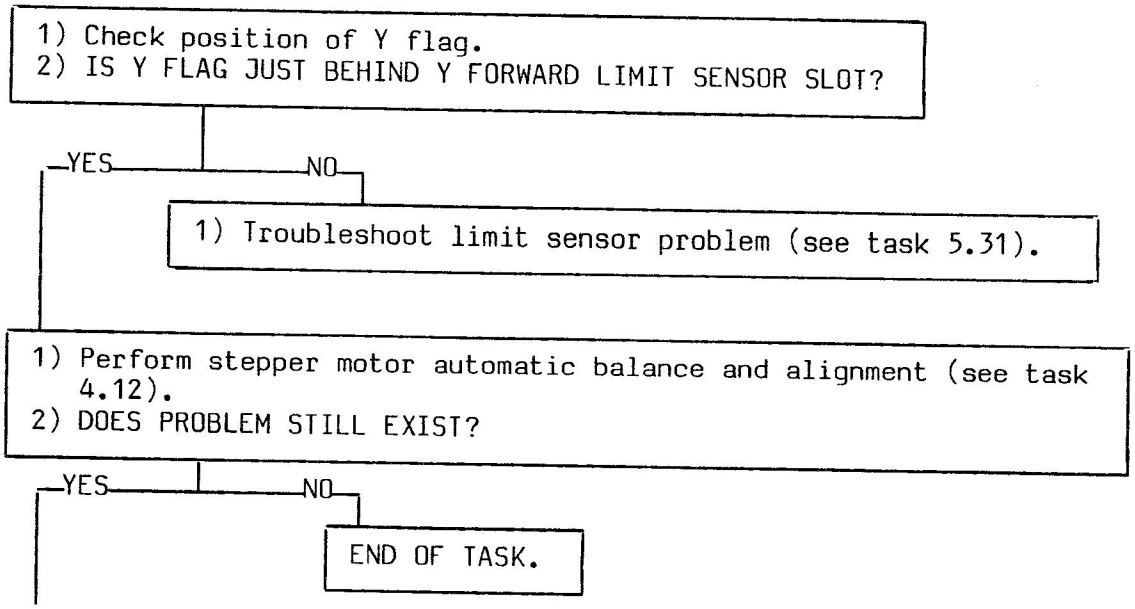


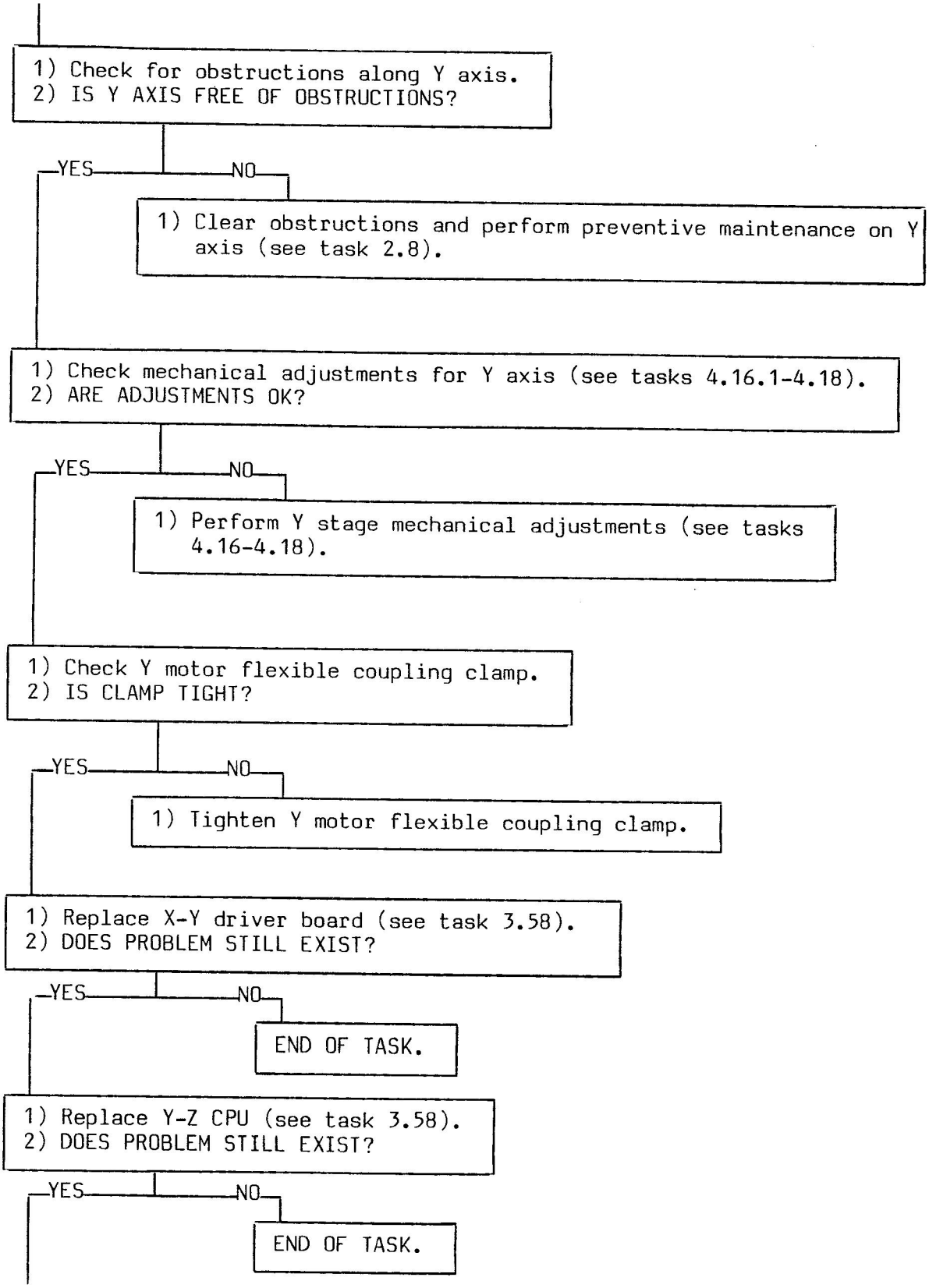
F223 - Y FORWARD LIMIT HIT

This fault indicates that the CPU has detected a 0 volt signal from the Y forward limit sensor when the Y stage should not be at the forward limit.

To isolate the fault:

NOTE: CONTINUE WITH FAULT ISOLATION PROCEDURE UNTIL A FAULT IS FOUND. CHECK TO SEE THAT REPAIR ACTIONS STOP DISPLAY OF FAULT CODE. ALWAYS INSTALL REMOVED PARTS BEFORE COMPLETING TASK.




1) Check for obstructions along Y axis.
2) IS Y AXIS FREE OF OBSTRUCTIONS?
YES
NO
1) Clear obstructions and perform preventive maintenance on Y axis (see task 2.8).
1) Check mechanical adjustments for Y axis (see tasks 4.16.1-4.18).
2) ARE ADJUSTMENTS OK?
YES
NO
1) Perform Y stage mechanical adjustments (see tasks 4.16-4.18).
1) Check Y motor flexible coupling clamp.
2) IS CLAMP TIGHT?
YES
NO
1) Tighten Y motor flexible coupling clamp.
1) Replace X-Y driver board (see task 3.58).
2) DOES PROBLEM STILL EXIST?
YES
NO
END OF TASK.
1) Replace Y-Z CPU (see task 3.58).
2) DOES PROBLEM STILL EXIST?
YES
NO
END OF TASK.

1) Replace housekeeper CPU (see task 3.58).
2) DOES PROBLEM STILL EXIST?

YES — 1) Troubleshoot mother/logic board - fault display system (see task 5.29).

NO — END OF TASK.

F224 - THETA CCW LIMIT HIT

This fault indicates that the CPU has detected a 0 volt signal from the theta limit sensor when the theta stage should not be at the CCW limit.

To isolate the fault:

NOTE: CONTINUE WITH FAULT ISOLATION PROCEDURE UNTIL A FAULT IS FOUND. CHECK TO SEE THAT REPAIR ACTIONS STOP DISPLAY OF FAULT CODE. ALWAYS INSTALL REMOVED PARTS BEFORE COMPLETING TASK.

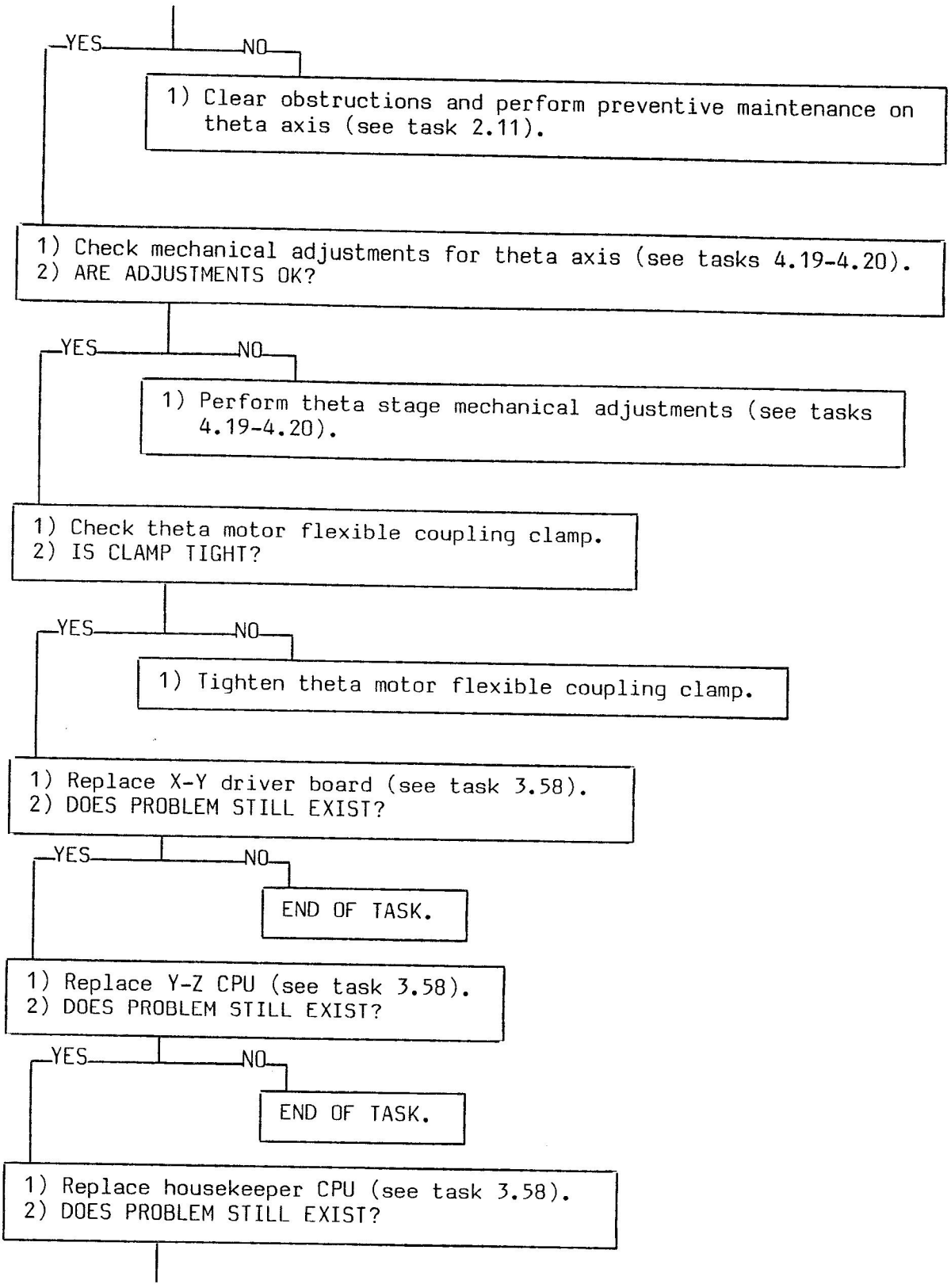
1) Check position of theta flag.
2) IS THETA FLAG JUST CW OF THETA CCW LIMIT SENSOR SLOT?

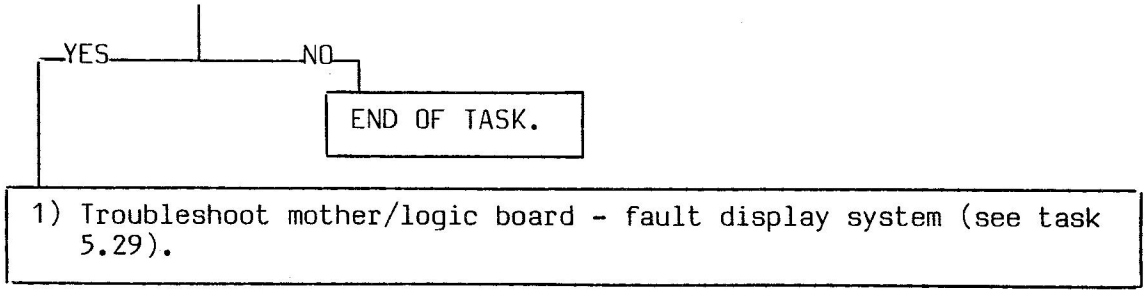
NO — 1) Troubleshoot limit sensor problem (see task 5.31).

YES — 1) Perform stepper motor automatic balance and alignment (see task 4.12).
2) DOES PROBLEM STILL EXIST?

NO — END OF TASK.

YES — 1) Check for obstructions along theta axis.
2) IS THETA AXIS FREE OF OBSTRUCTIONS?


YES
NO
1) Clear obstructions and perform preventive maintenance on theta axis (see task 2.11).
1) Check mechanical adjustments for theta axis (see tasks 4.19-4.20).
2) ARE ADJUSTMENTS OK?
YES
NO
1) Perform theta stage mechanical adjustments (see tasks 4.19-4.20).
1) Check theta motor flexible coupling clamp.
2) IS CLAMP TIGHT?
YES
NO
1) Tighten theta motor flexible coupling clamp.
1) Replace X-Y driver board (see task 3.58).
2) DOES PROBLEM STILL EXIST?
YES
NO
END OF TASK.
1) Replace Y-Z CPU (see task 3.58).
2) DOES PROBLEM STILL EXIST?
YES
NO
END OF TASK.
1) Replace housekeeper CPU (see task 3.58).
2) DOES PROBLEM STILL EXIST?

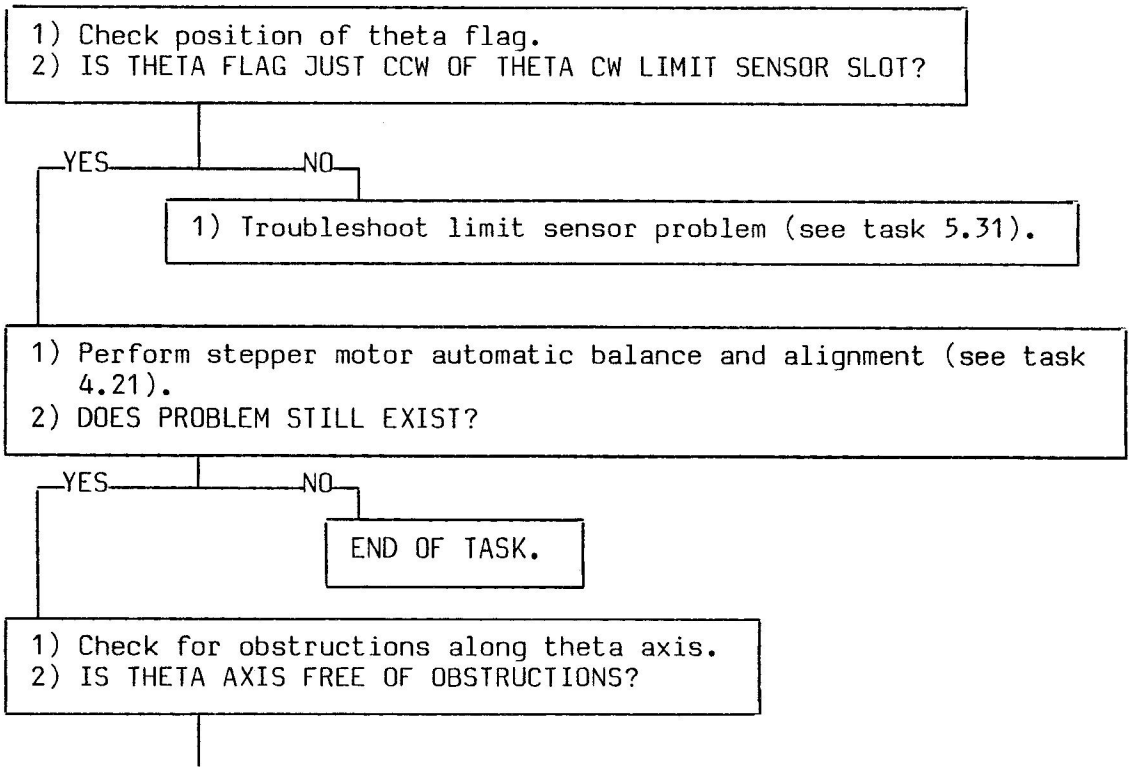


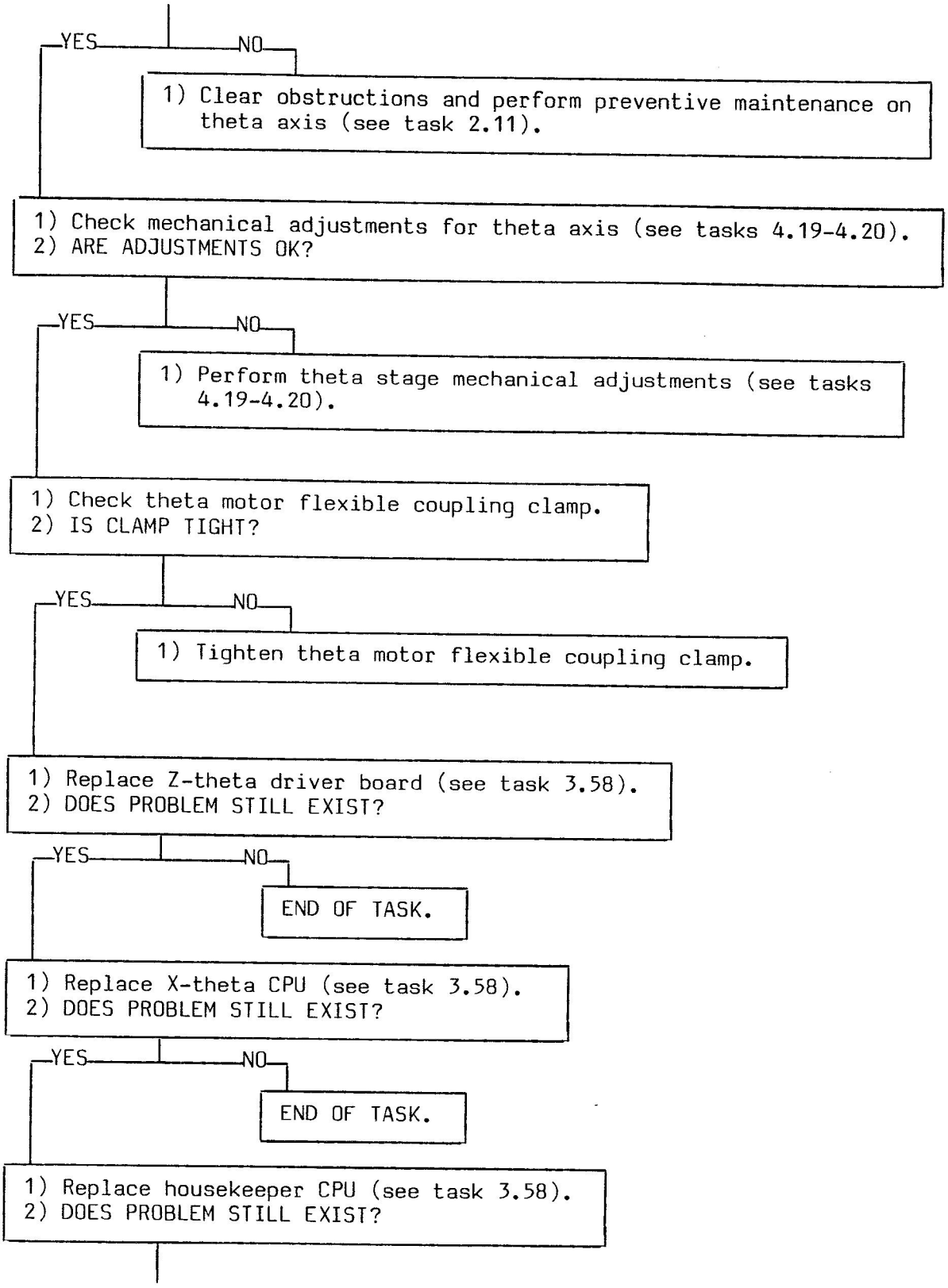
F225 - THETA CW LIMIT HIT

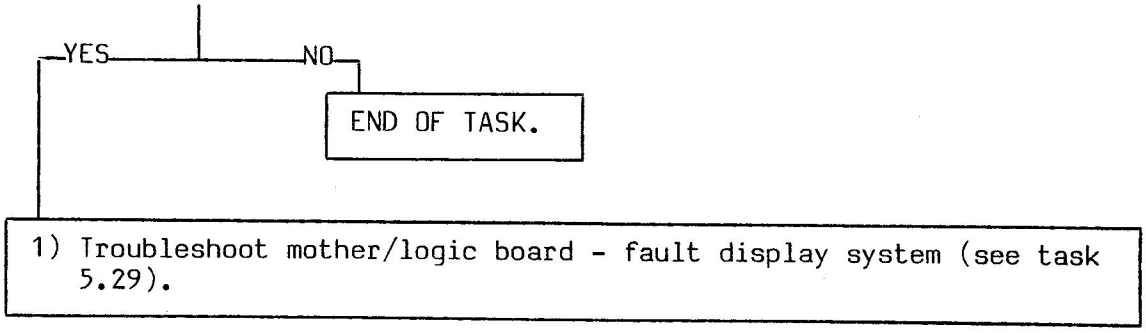
This fault indicates that the CPU has detected a 0 volt signal from the theta limit sensor when the theta stage should not be at the CW limit.

To isolate the fault:

NOTE: CONTINUE WITH FAULT ISOLATION PROCEDURE UNTIL A FAULT IS FOUND. CHECK TO SEE THAT REPAIR ACTIONS STOP DISPLAY OF FAULT CODE. ALWAYS INSTALL REMOVED PARTS BEFORE COMPLETING TASK.




YES
NO
1) Clear obstructions and perform preventive maintenance on theta axis (see task 2.11).
1) Check mechanical adjustments for theta axis (see tasks 4.19-4.20).
2) ARE ADJUSTMENTS OK?
YES
NO
1) Perform theta stage mechanical adjustments (see tasks 4.19-4.20).
1) Check theta motor flexible coupling clamp.
2) IS CLAMP TIGHT?
YES
NO
1) Tighten theta motor flexible coupling clamp.
1) Replace Z-theta driver board (see task 3.58).
2) DOES PROBLEM STILL EXIST?
YES
NO
END OF TASK.
1) Replace X-theta CPU (see task 3.58).
2) DOES PROBLEM STILL EXIST?
YES
NO
END OF TASK.
1) Replace housekeeper CPU (see task 3.58).
2) DOES PROBLEM STILL EXIST?

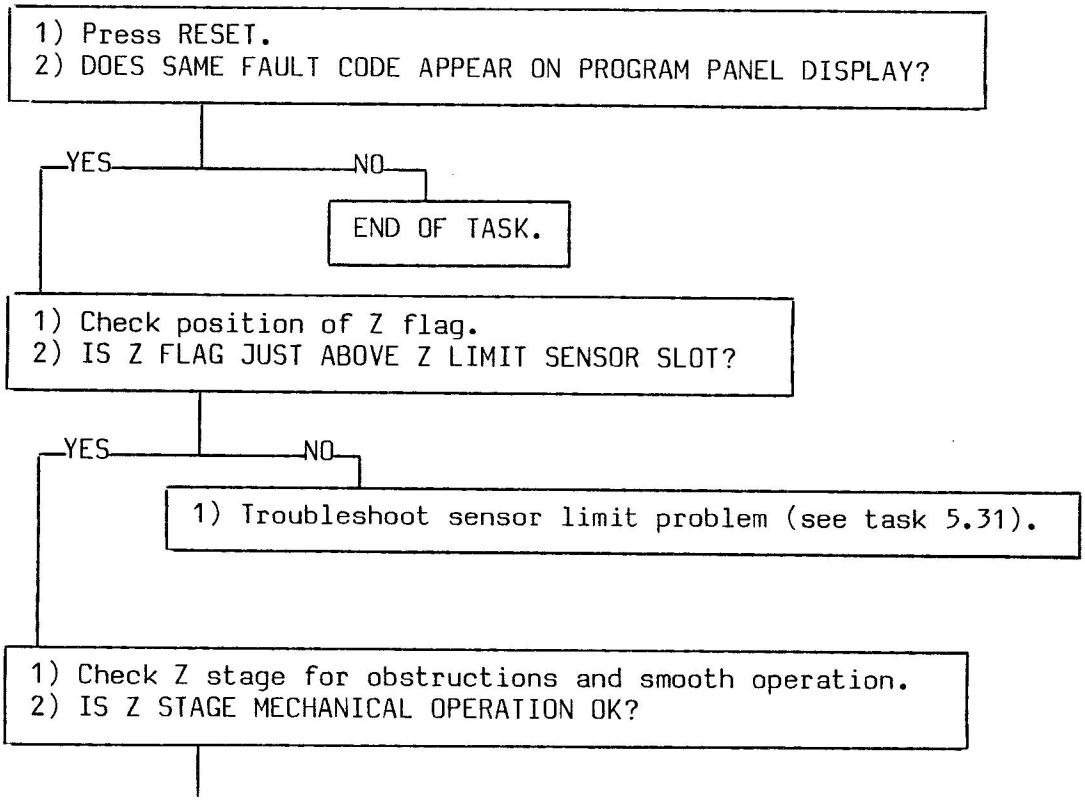


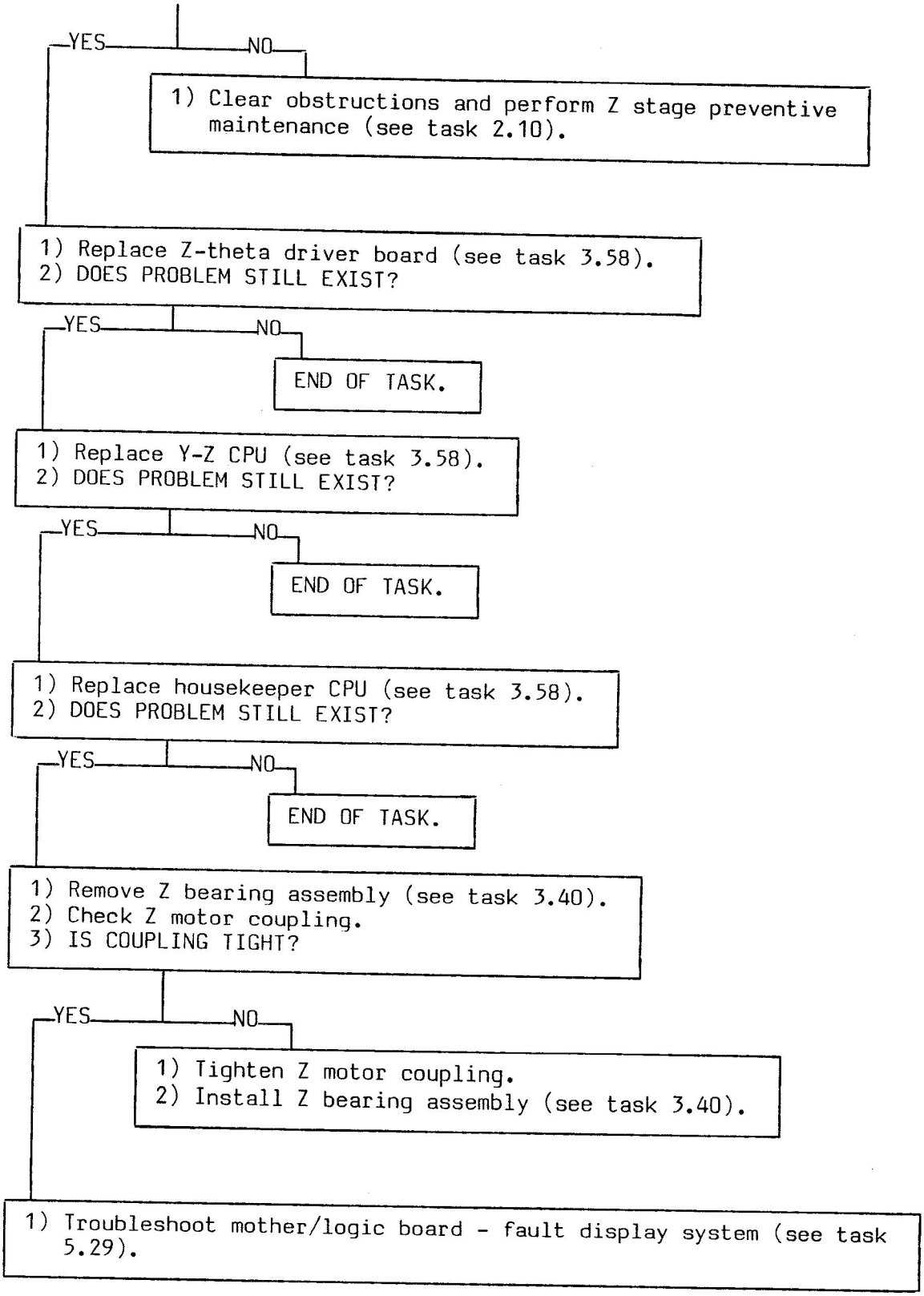
F226 - Z DOWN LIMIT HIT

This fault indicates that the CPU has detected a 0 volt signal from the Z limit sensor when the Z stage should not be at the lower limit.

To isolate the fault:

NOTE: CONTINUE WITH FAULT ISOLATION PROCEDURE UNTIL A FAULT IS FOUND. CHECK TO SEE THAT REPAIR ACTIONS STOP DISPLAY OF FAULT CODE. ALWAYS INSTALL REMOVED PARTS BEFORE COMPLETING TASK.



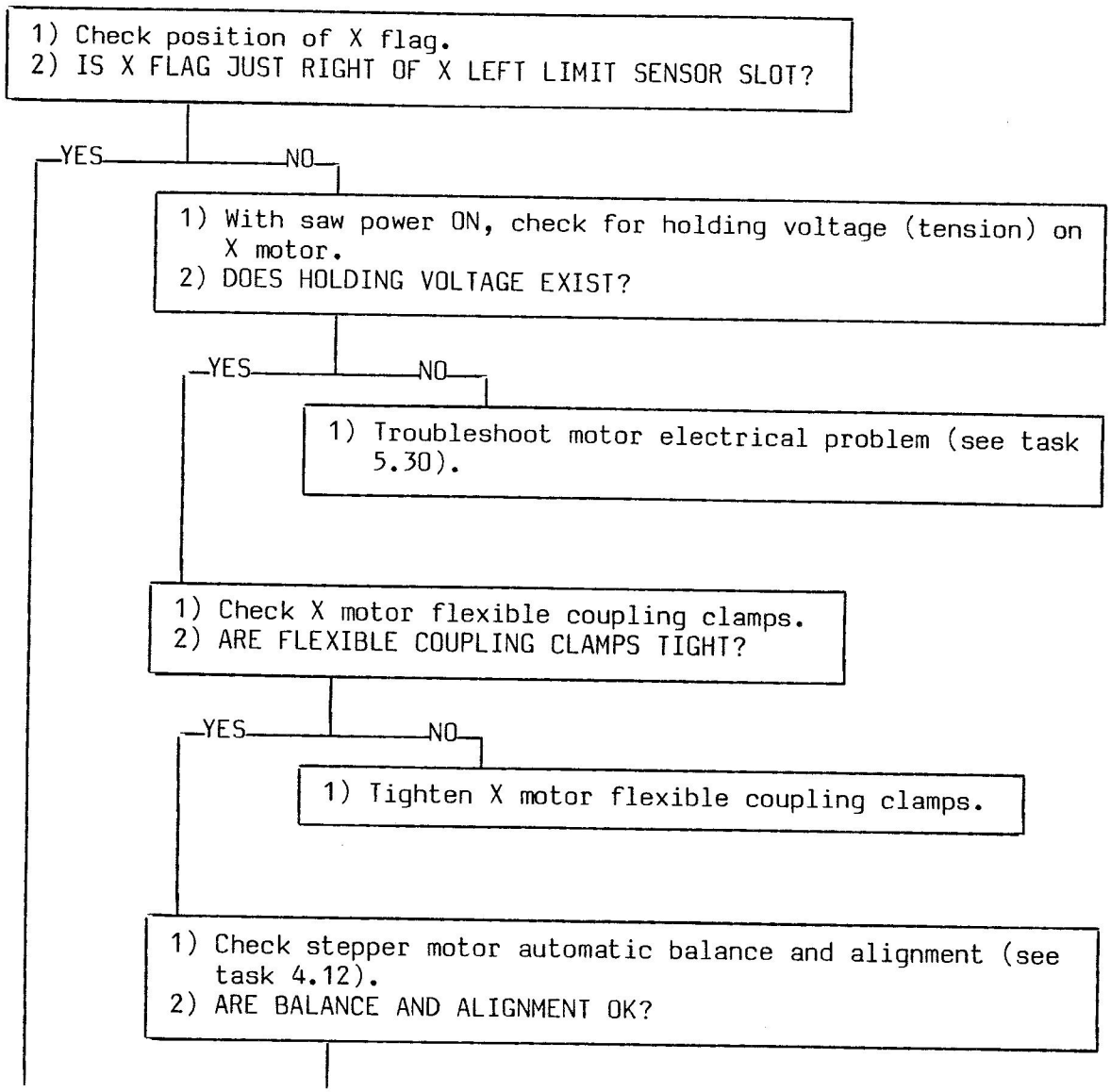

YES
NO
1) Clear obstructions and perform Z stage preventive maintenance (see task 2.10).
1) Replace Z-theta driver board (see task 3.58).
2) DOES PROBLEM STILL EXIST?
YES
NO
END OF TASK.
1) Replace Y-Z CPU (see task 3.58).
2) DOES PROBLEM STILL EXIST?
YES
NO
END OF TASK.
1) Replace housekeeper CPU (see task 3.58).
2) DOES PROBLEM STILL EXIST?
YES
NO
END OF TASK.
1) Remove Z bearing assembly (see task 3.40).
2) Check Z motor coupling.
3) IS COUPLING TIGHT?
YES
NO
1) Tighten Z motor coupling.
2) Install Z bearing assembly (see task 3.40).
1) Troubleshoot mother/logic board - fault display system (see task 5.29).

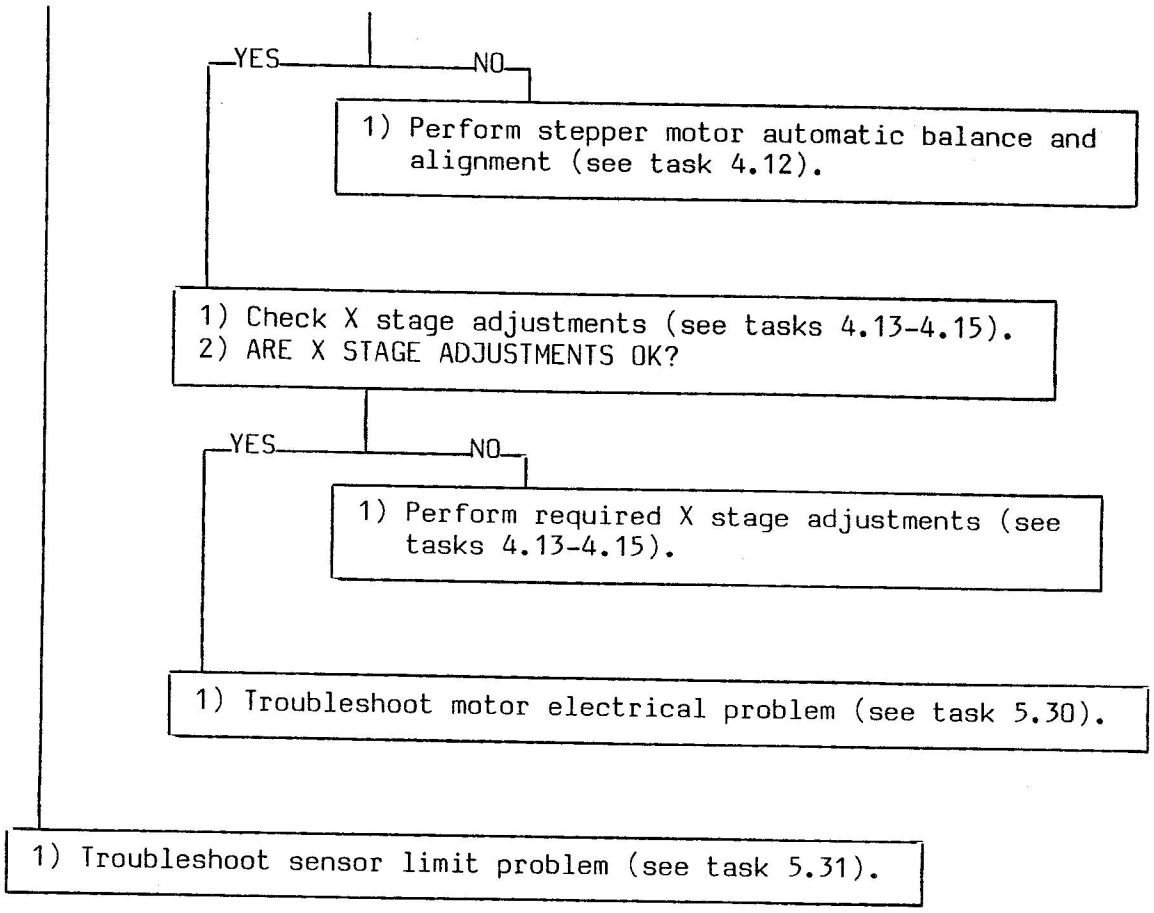
F230 - X LEFT SENSOR NOT DETECTED

This fault code is displayed when the X stage is HOMING and the X-OCPU (C2) has given a number of pulses to the X motor sensor without detecting the X left limit sensor.

To isolate the fault:

NOTE: CONTINUE WITH FAULT ISOLATION PROCEDURE UNTIL A FAULT IS FOUND. CHECK TO SEE THAT REPAIR ACTIONS STOP DISPLAY OF FAULT CODE. ALWAYS INSTALL REMOVED PARTS BEFORE COMPLETING TASK.





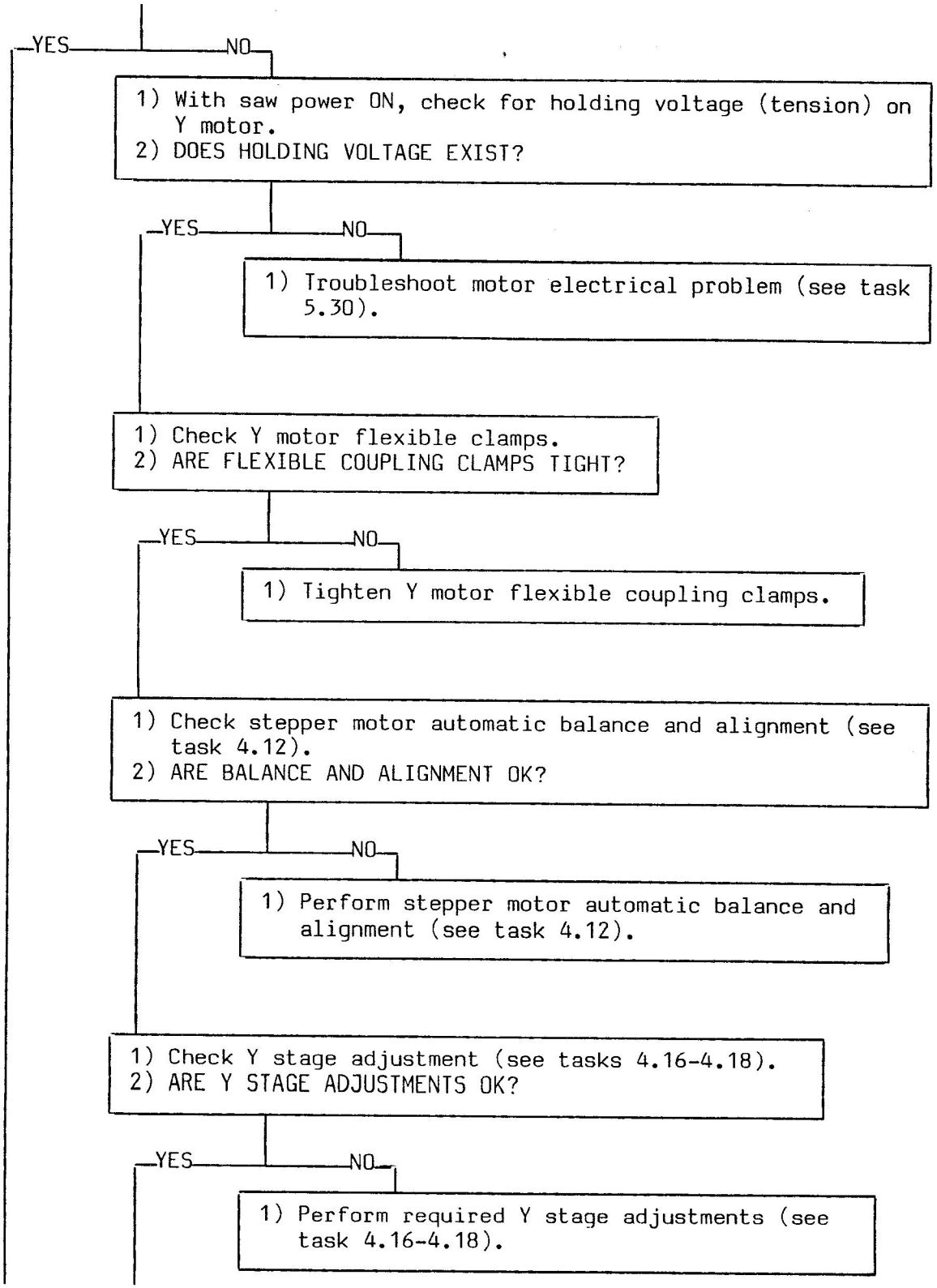
F232 - Y REAR SENSOR NOT DETECTED

This fault code is displayed when the Y stage is HOMING and the Y-Z CPU (C3) has detected a given number of pulses from the y motor sensor without detecting the Y rear limit sensor.

To isolate the fault:

NOTE: CONTINUE WITH FAULT ISOLATION PROCEDURE UNTIL A FAULT IS FOUND. CHECK TO SEE THAT REPAIR ACTIONS STOP DISPLAY OF FAULT CODE. ALWAYS INSTALL REMOVED PARTS BEFORE COMPLETING TASK.

1) Check position of Y flag.
2) IS Y FLAG JUST FORWARD OF Y REAR LIMIT SENSOR SLOT?


YES
NO
1) With saw power ON, check for holding voltage (tension) on Y motor.
2) DOES HOLDING VOLTAGE EXIST?
YES
NO
1) Troubleshoot motor electrical problem (see task 5.30).
1) Check Y motor flexible clamps.
2) ARE FLEXIBLE COUPLING CLAMPS TIGHT?
YES
NO
1) Tighten Y motor flexible coupling clamps.
1) Check stepper motor automatic balance and alignment (see task 4.12).
2) ARE BALANCE AND ALIGNMENT OK?
YES
NO
1) Perform stepper motor automatic balance and alignment (see task 4.12).
1) Check Y stage adjustment (see tasks 4.16-4.18).
2) ARE Y STAGE ADJUSTMENTS OK?
YES
NO
1) Perform required Y stage adjustments (see task 4.16-4.18).

1) Troubleshoot motor electrical problem (see task 5.30).

1) Troubleshoot sensor limit problem (see task 5.31).

F234 - THETA CCW SENSOR NOT DETECTED

This fault code is displayed when the theta stage is HOMING and the X-theta CPU (C2) has detected a given number of pulses from the theta motor sensor without detecting the theta CCW limit sensor.

To isolate the fault:

NOTE: CONTINUE WITH FAULT ISOLATION PROCEDURE UNTIL A FAULT IS FOUND. CHECK TO SEE THAT REPAIR ACTIONS STOP DISPLAY OF FAULT CODE. ALWAYS INSTALL REMOVED PARTS BEFORE COMPLETING TASK.

1) Check position of theta flag.
2) IS THETA FLAG JUST CW OF THETA CCW LIMIT SENSOR SLOT?

YES

NO

1) With saw power ON, check for holding voltage (tension) on theta motor.
2) DOES HOLDING VOLTAGE EXIST?

YES

NO

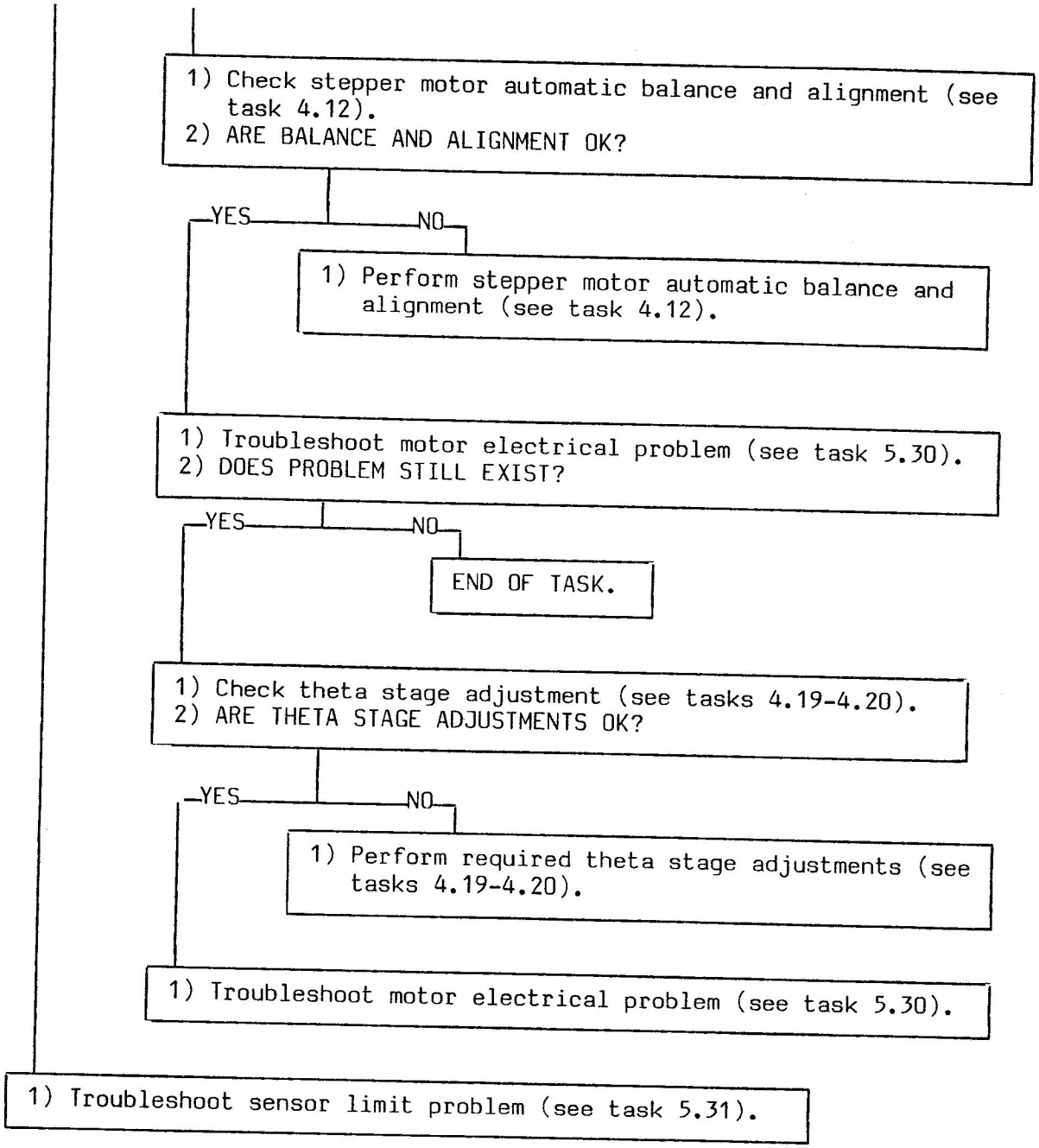
1) Troubleshoot motor electrical problem (see task 5.30).

1) Check theta motor flexible clamps.
2) ARE FLEXIBLE COUPLING CLAMPS TIGHT?

YES

NO

1) Tighten theta motor flexible coupling clamps.

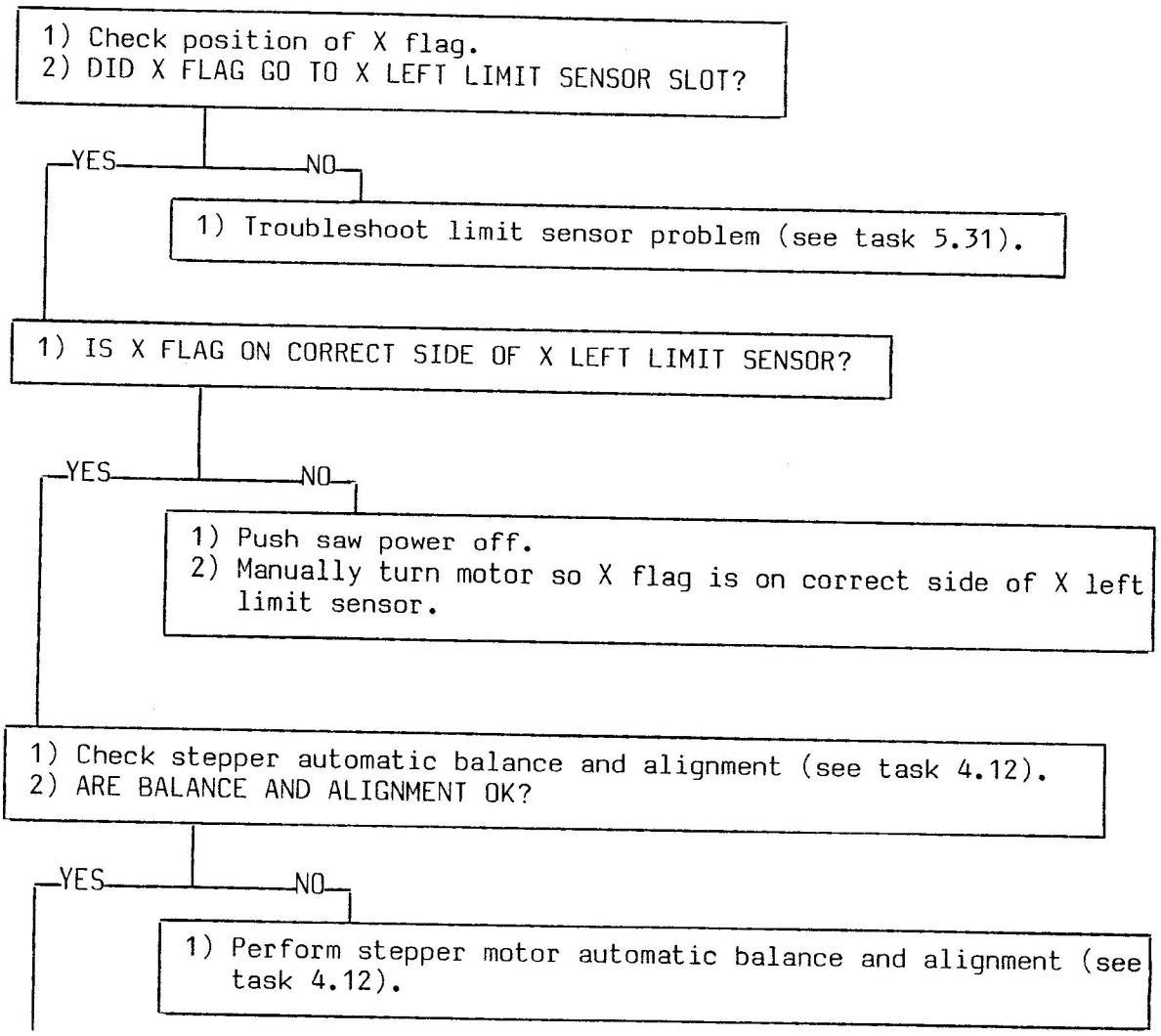

1) Check stepper motor automatic balance and alignment (see task 4.12).
2) ARE BALANCE AND ALIGNMENT OK?
YES
NO
1) Perform stepper motor automatic balance and alignment (see task 4.12).
1) Troubleshoot motor electrical problem (see task 5.30).
2) DOES PROBLEM STILL EXIST?
YES
NO
END OF TASK.
1) Check theta stage adjustment (see tasks 4.19-4.20).
2) ARE THETA STAGE ADJUSTMENTS OK?
YES
NO
1) Perform required theta stage adjustments (see tasks 4.19-4.20).
1) Troubleshoot motor electrical problem (see task 5.30).
1) Troubleshoot sensor limit problem (see task 5.31).

F240 - X LEFT SENSOR STILL DETECTED

This fault code occurs during a HOMING sequence when the X motor CPU (C2) has sent a pre-determined number of step commands to the X motor driver (C6) without detecting that the X left limit sensor output at TP5 has switched to 5 VDC ± .5 V.

To isolate fault:

NOTE: CONTINUE WITH FAULT ISOLATION PROCEDURE UNTIL A FAULT IS FOUND. CHECK TO SEE THAT REPAIR ACTIONS STOP DISPLAY OF FAULT CODE. ALWAYS INSTALL REMOVED PARTS BEFORE COMPLETING TASK.



1) Troubleshoot motor electric problem (see task 5.30).

F242 - Y REAR SENSOR STILL DETECTED

This fault code occurs during a HOMING sequence when the Y-Z CPU (C3) has sent a pre-determined number of step commands to the Y motor driver (C7) without detecting that the Y rear limit sensor output at TP3 has switched to 5 VDC ± .5 V.

To isolate fault:

NOTE: CONTINUE WITH FAULT ISOLATION PROCEDURE UNTIL A FAULT IS FOUND. CHECK TO SEE THAT REPAIR ACTIONS STOP DISPLAY OF FAULT CODE. ALWAYS INSTALL REMOVED PARTS BEFORE COMPLETING TASK.

1) Check position of Y flag.
2) DID Y FLAG GO TO Y REAR LIMIT SENSOR SLOT?

YES — NO

1) Troubleshoot limit sensor problem (see task 5.31).

1) IS Y FLAG ON CORRECT SIDE OF Y REAR SENSOR?

YES — NO

1) Push saw power off.
2) Manually turn motor so Y flag is on correct side of X left limit sensor.

1) Check stepper automatic balance and alignment (see task 4.12).
2) ARE BALANCE AND ALIGNMENT OK?

YES — NO

1) Perform stepper motor automatic balance and alignment (see task 4.12).

1) Troubleshoot motor electric problem (see task 5.30).

F244 - THETA CCW SENSOR STILL DETECTED

This fault code occurs during a HOMING sequence when the X-theta CPU (C2) has sent a pre-determined number of step commands to the theta motor driver (C8) without detecting that the theta limit sensor output at TP5 has switched to 5 VDC ± .5 V.

To isolate fault:

NOTE: CONTINUE WITH FAULT ISOLATION PROCEDURE UNTIL A FAULT IS FOUND. CHECK TO SEE THAT REPAIR ACTIONS STOP DISPLAY OF FAULT CODE. ALWAYS INSTALL REMOVED PARTS BEFORE COMPLETING TASK.

1) Check position of theta flag.
2) DID THETA FLAG GO TO THETA CCW LIMIT SENSOR SLOT?

YES

NO

1) Troubleshoot limit sensor problem (see task 5.31).

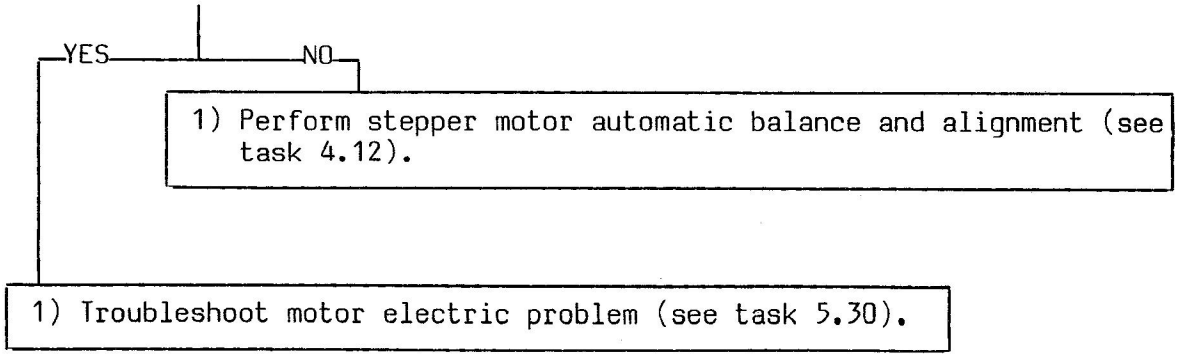
1) IS THETA FLAG ON CORRECT SIDE OF CCW SENSOR?

YES

NO

1) Push saw power off.
2) Manually turn motor so theta flag is on correct side of theta CCW limit sensor.

1) Check stepper automatic balance and alignment (see task 4.12).
2) ARE BALANCE AND ALIGNMENT OK?

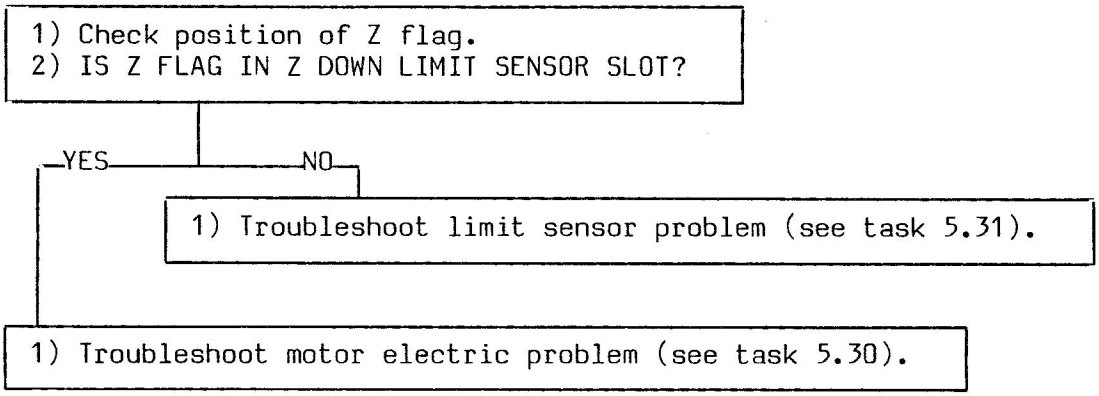


F246 - Z DOWN SENSOR STILL DETECTED

This fault code occurs during a HOMING sequence when the Y-Z CPU (C3) has sent a pre-determined number of step commands to the Z motor driver (C8) without detecting that the Z down limit sensor output at TP3 has switched to 5 VDC ± .5 V.

To isolate fault:

NOTE: CONTINUE WITH FAULT ISOLATION PROCEDURE UNTIL A FAULT IS FOUND. CHECK TO SEE THAT REPAIR ACTIONS STOP DISPLAY OF FAULT CODE. ALWAYS INSTALL REMOVED PARTS BEFORE COMPLETING TASK.

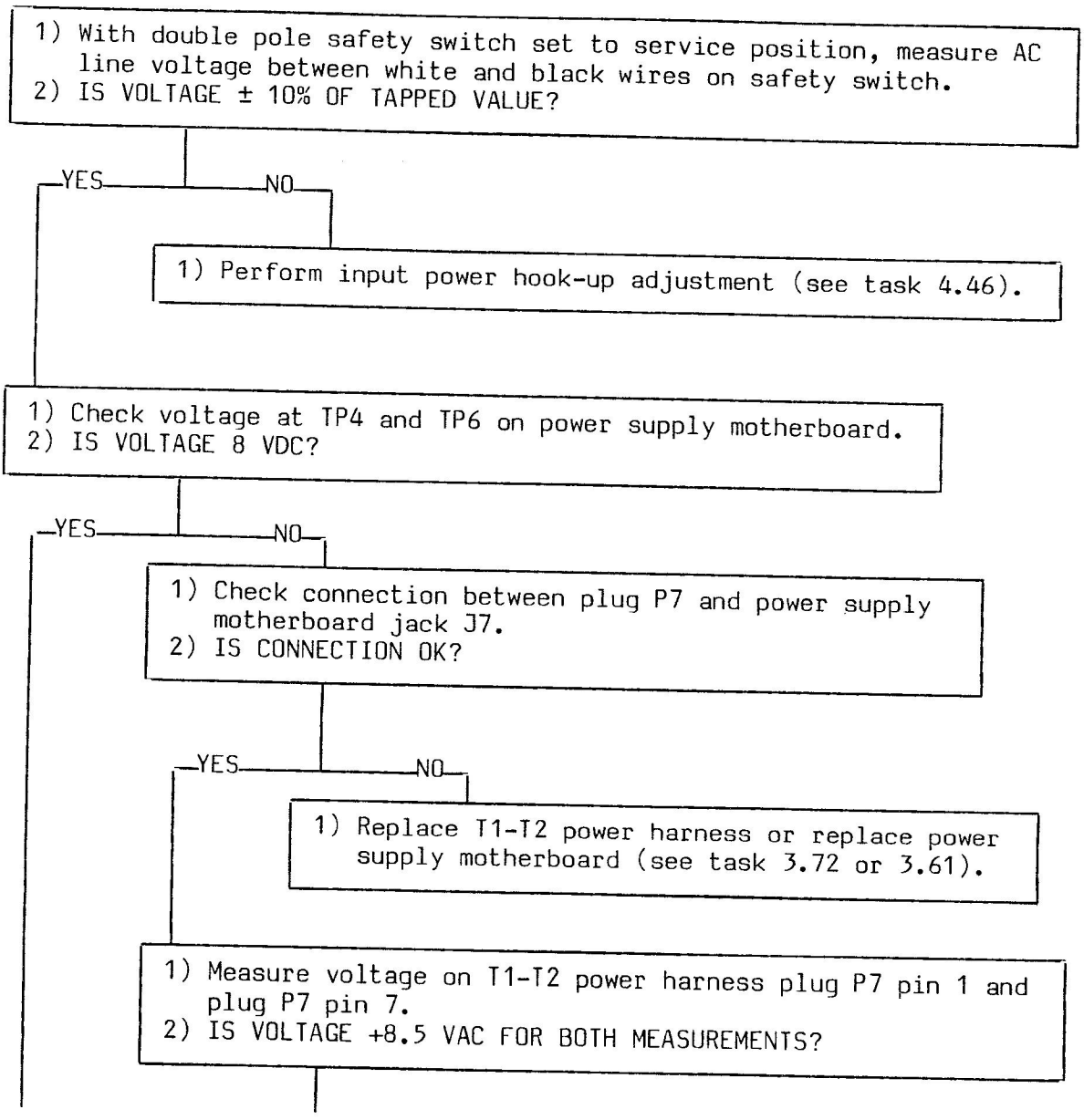


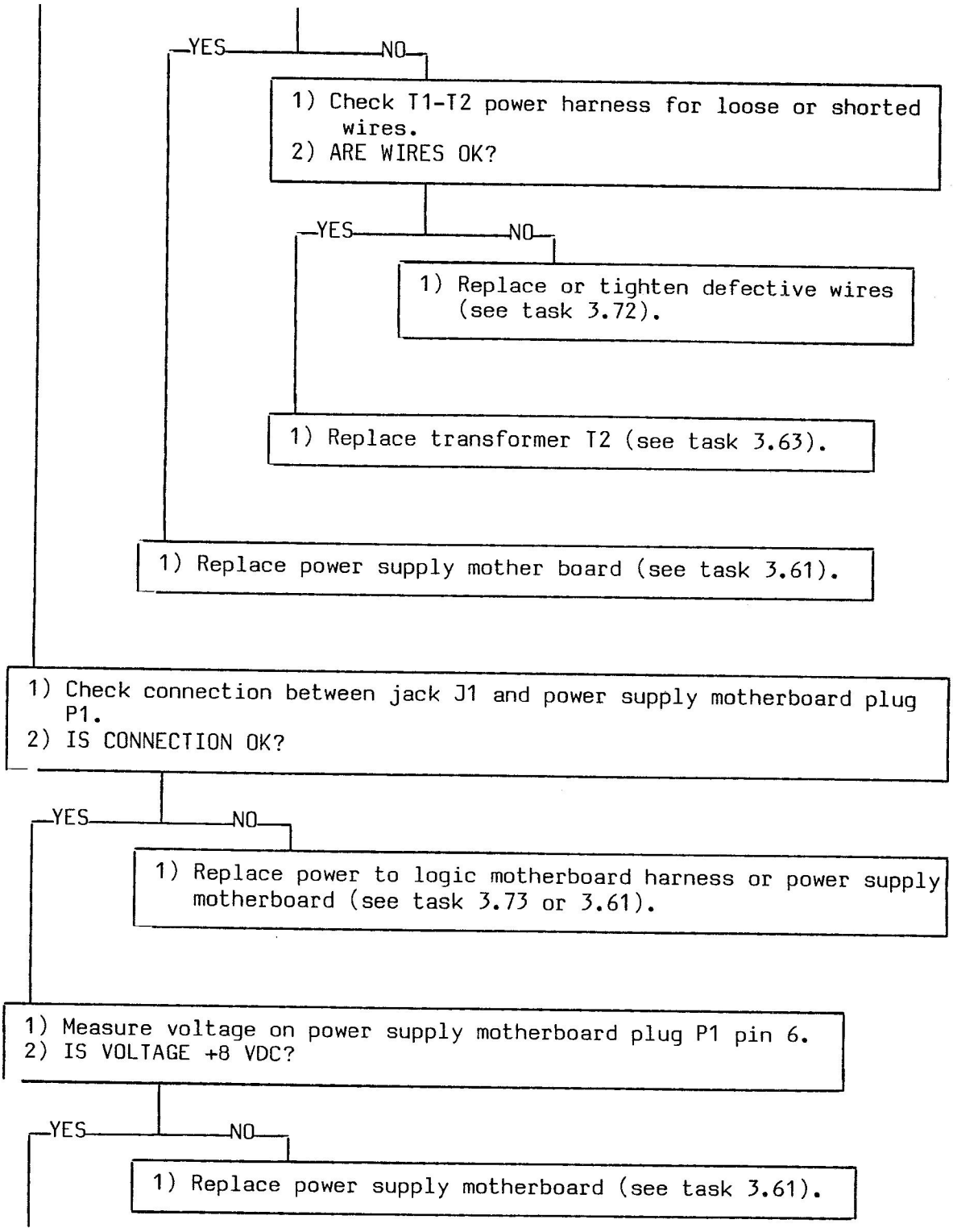
F250 - INPUT VOLTAGE OUT OF RANGE

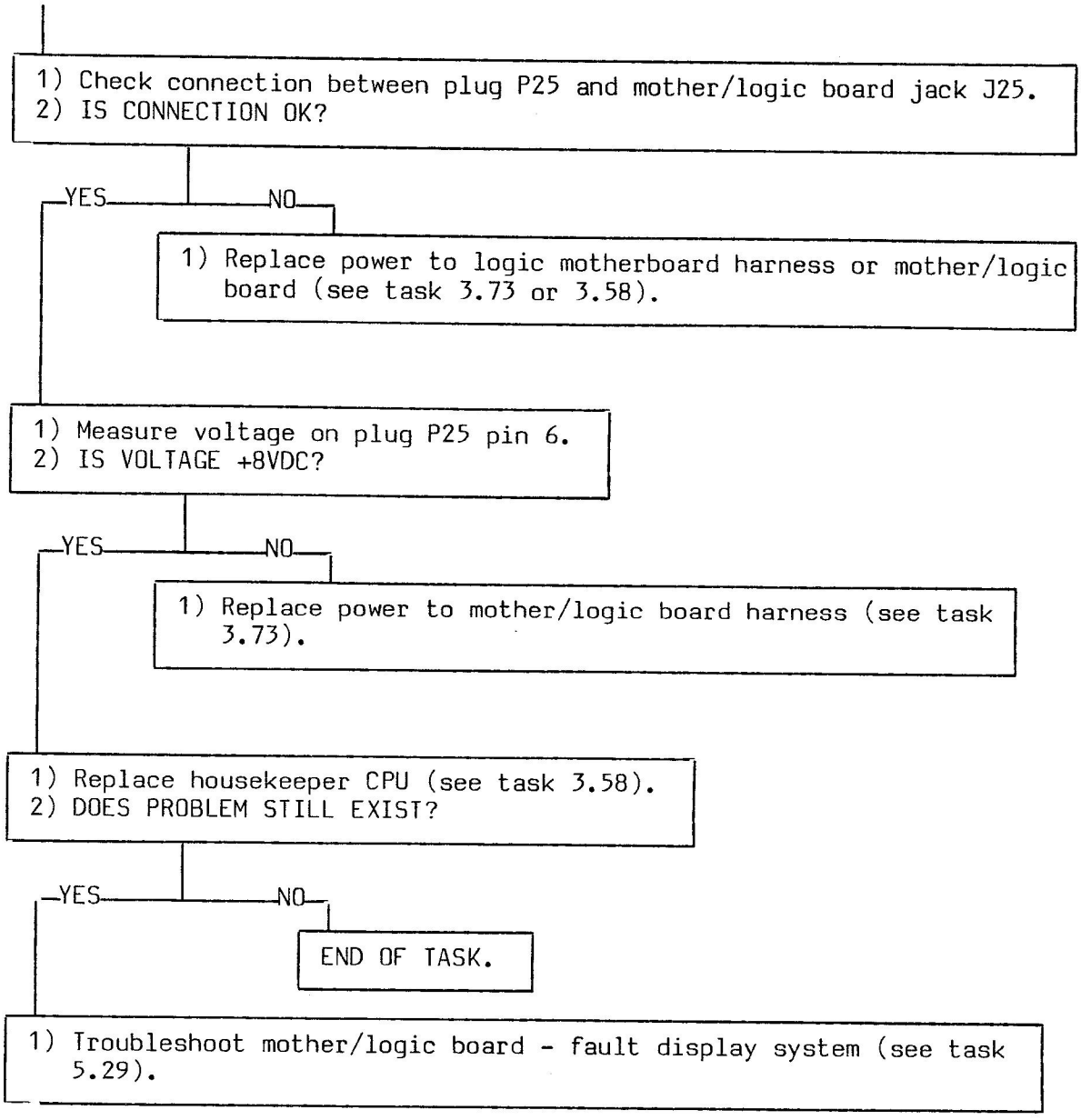
This failure code indicates that the CPU has received a power input too low or too high

To isolate fault:

NOTE: CONTINUE WITH FAULT ISOLATION PROCEDURE UNTIL A FAULT IS FOUND. CHECK TO SEE THAT REPAIR ACTIONS STOP DISPLAY OF FAULT CODE. ALWAYS INSTALL REMOVED PARTS BEFORE COMPLETING TASK.



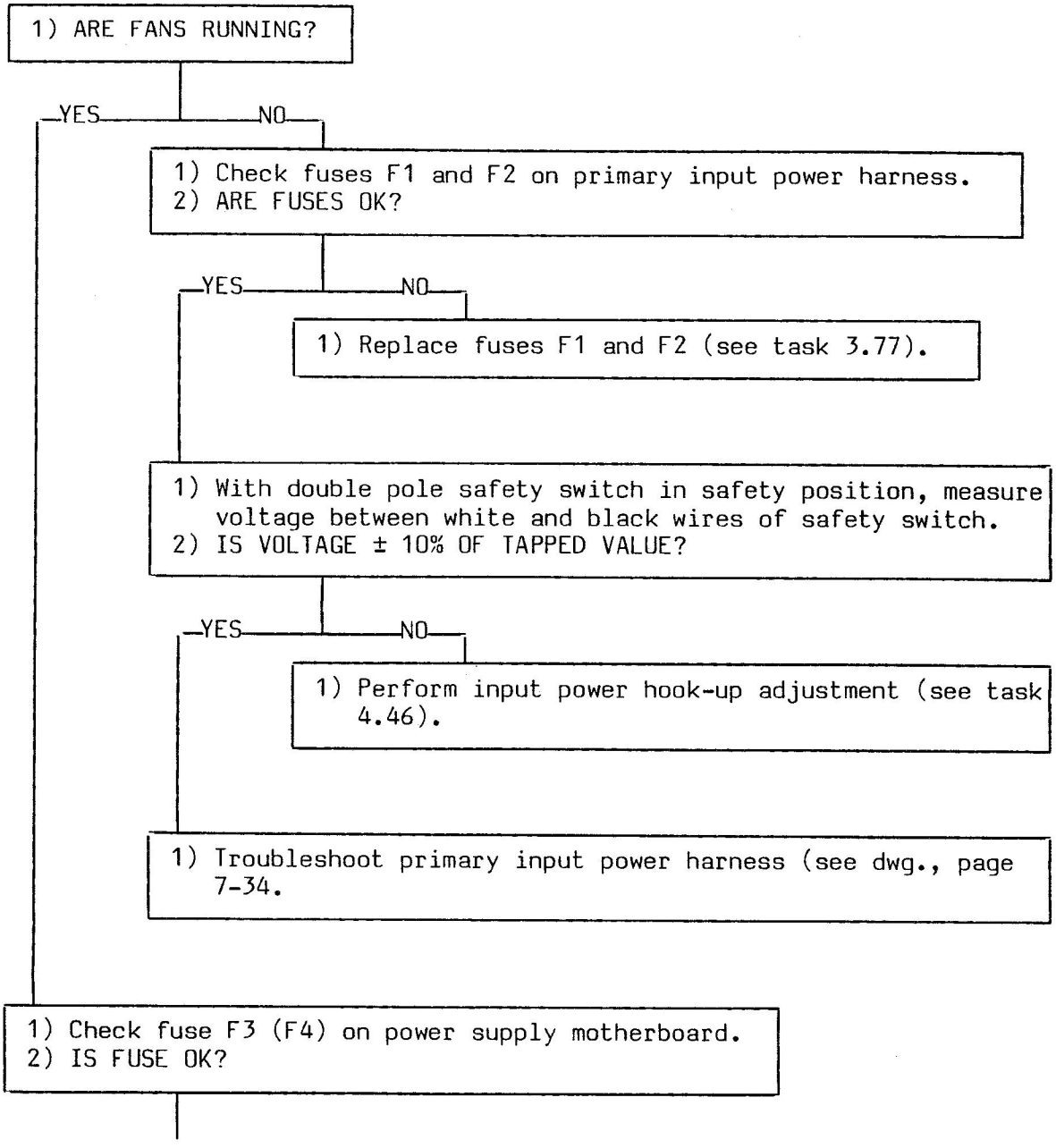

YES
NO
1) Check T1-T2 power harness for loose or shorted wires.
2) ARE WIRES OK?
YES
NO
1) Replace or tighten defective wires (see task 3.72).
1) Replace transformer T2 (see task 3.63).
1) Replace power supply mother board (see task 3.61).
1) Check connection between jack J1 and power supply motherboard plug P1.
2) IS CONNECTION OK?
YES
NO
1) Replace power to logic motherboard harness or power supply motherboard (see task 3.73 or 3.61).
1) Measure voltage on power supply motherboard plug P1 pin 6.
2) IS VOLTAGE +8 VDC?
YES
NO
1) Replace power supply motherboard (see task 3.61).

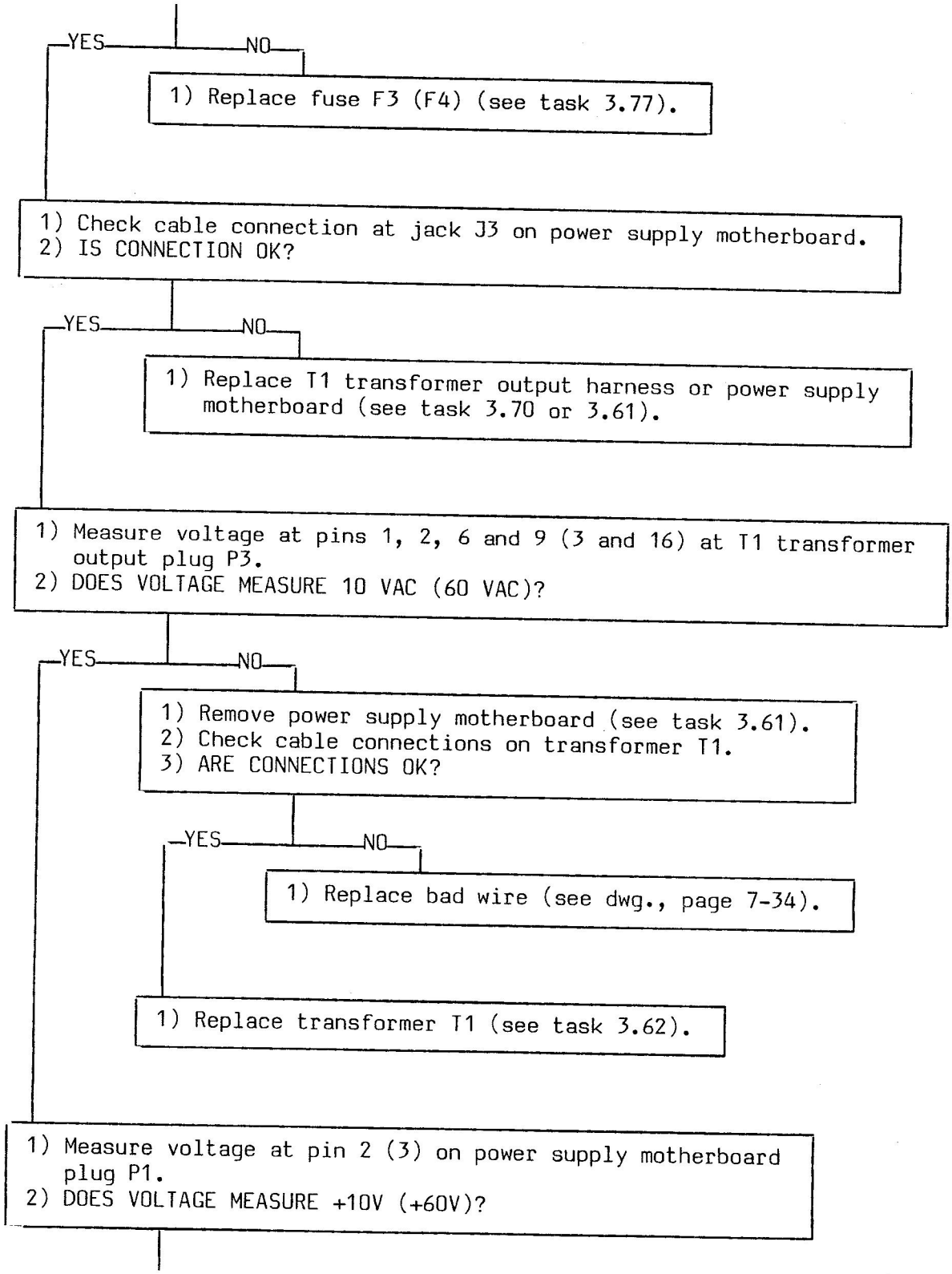

1) Check connection between plug P25 and mother/logic board jack J25.
2) IS CONNECTION OK?
YES
NO
1) Replace power to logic motherboard harness or mother/logic board (see task 3.73 or 3.58).
1) Measure voltage on plug P25 pin 6.
2) IS VOLTAGE +8VDC?
YES
NO
1) Replace power to mother/logic board harness (see task 3.73).
1) Replace housekeeper CPU (see task 3.58).
2) DOES PROBLEM STILL EXIST?
YES
NO
END OF TASK.
1) Troubleshoot mother/logic board - fault display system (see task 5.29).

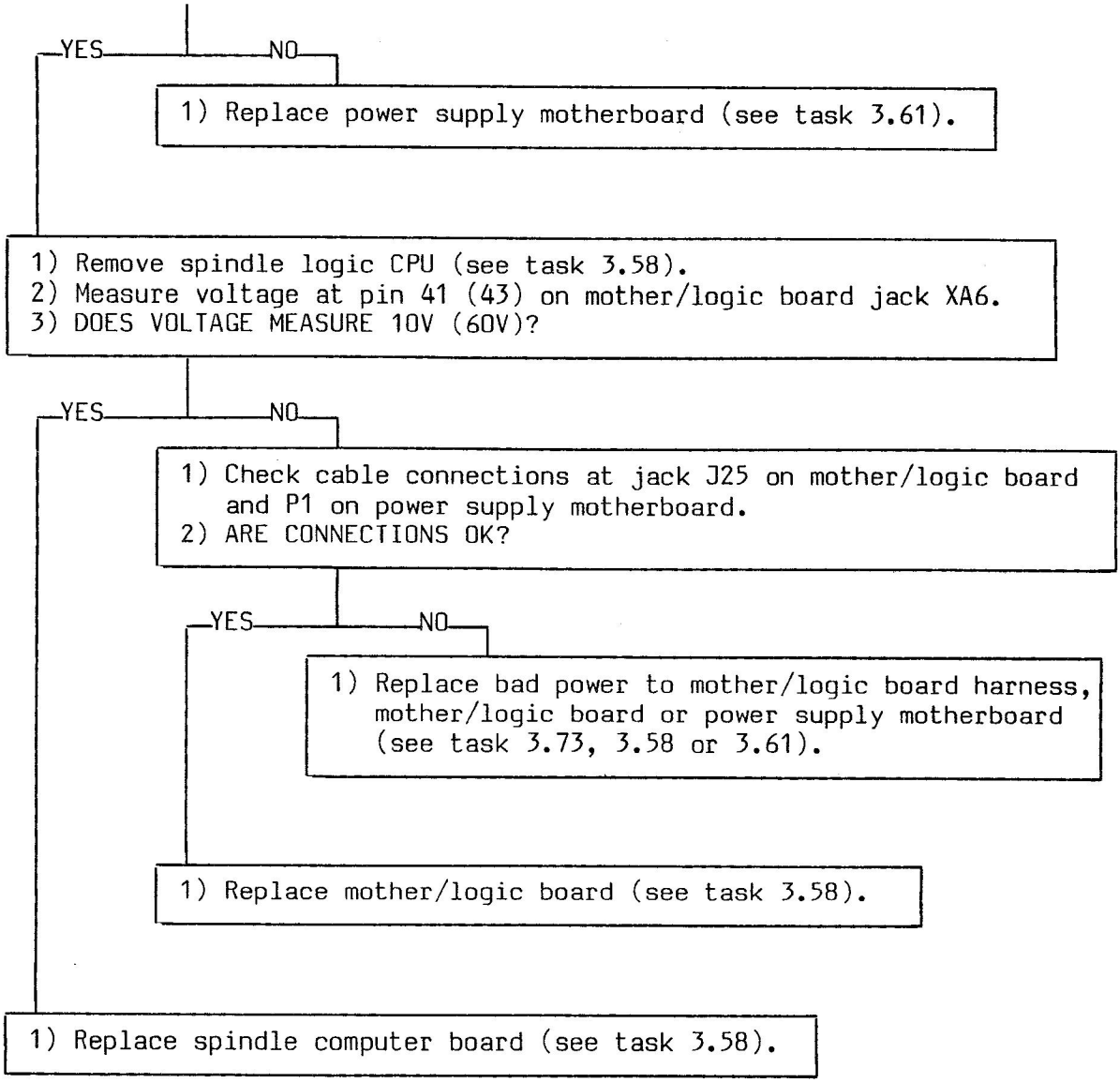
F333/F334 10 (60) VOLT SUPPLY OUT OF RANGE

NOTE: CONTINUE WITH FAULT ISOLATION PROCEDURE UNTIL A FAULT IS FOUND. CHECK TO SEE THAT REPAIR ACTIONS STOP DISPLAY OF FAULT CODE. ALWAYS INSTALL REMOVED PARTS BEFORE COMPLETING TASK.

NOTE: VALUES IN PARENTHESIS ARE FOR FAULT CODE F334.

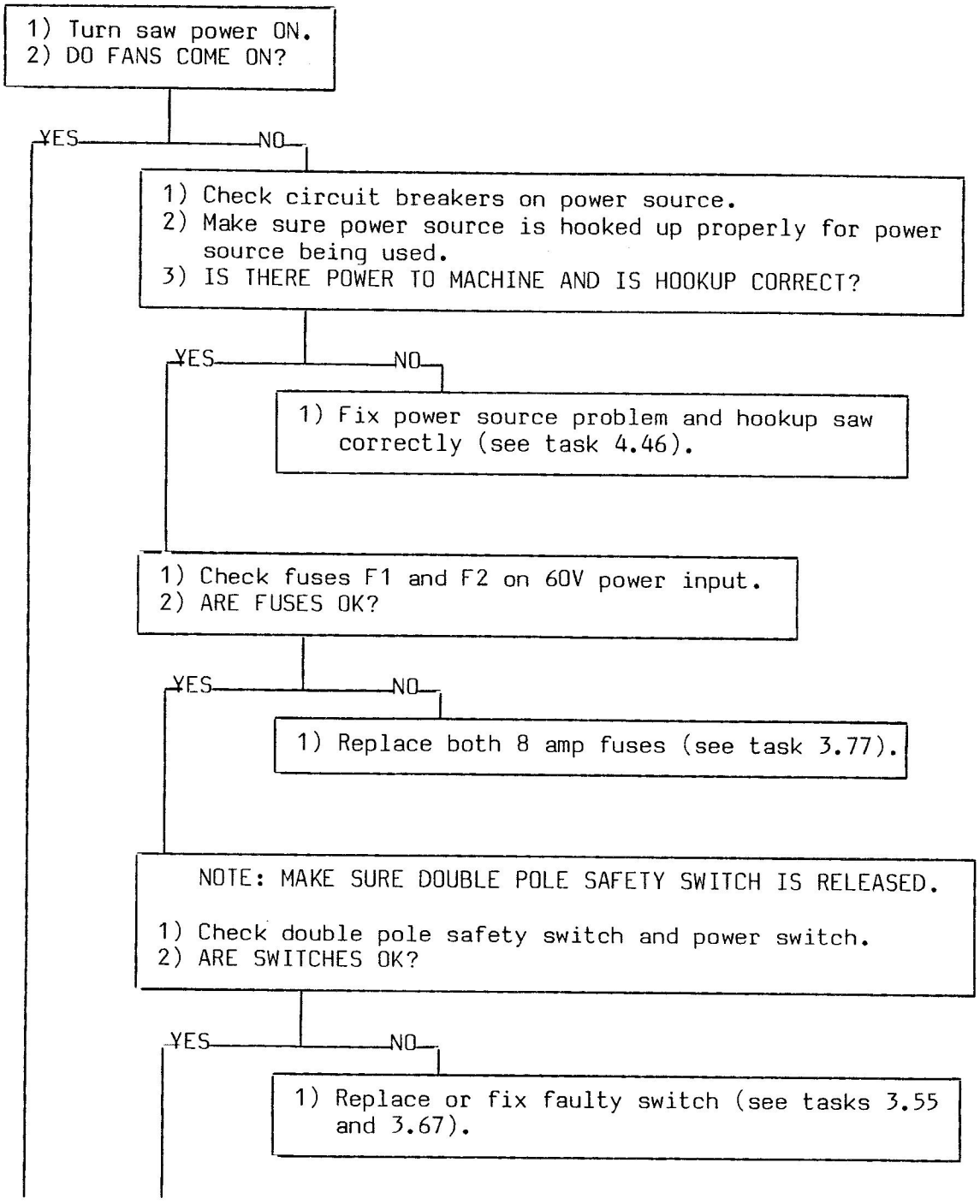


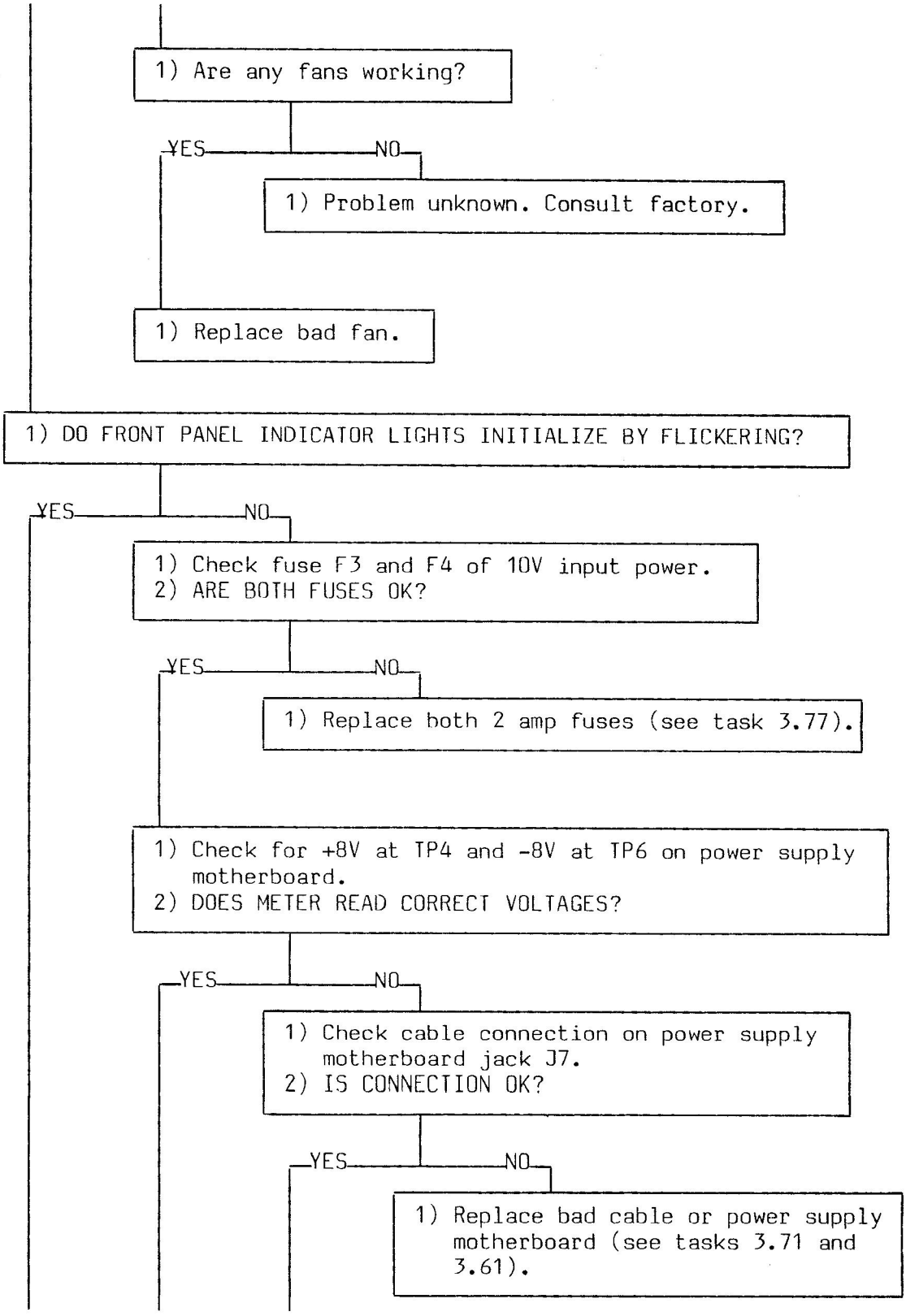

YES
NO
1) Replace fuse F3 (F4) (see task 3.77).
1) Check cable connection at jack J3 on power supply motherboard.
2) IS CONNECTION OK?
YES
NO
1) Replace T1 transformer output harness or power supply motherboard (see task 3.70 or 3.61).
1) Measure voltage at pins 1, 2, 6 and 9 (3 and 16) at T1 transformer output plug P3.
2) DOES VOLTAGE MEASURE 10 VAC (60 VAC)?
YES
NO
1) Remove power supply motherboard (see task 3.61).
2) Check cable connections on transformer T1.
3) ARE CONNECTIONS OK?
YES
NO
1) Replace bad wire (see dwg., page 7-34).
1) Replace transformer T1 (see task 3.62).
1) Measure voltage at pin 2 (3) on power supply motherboard plug P1.
2) DOES VOLTAGE MEASURE +10V (+60V)?

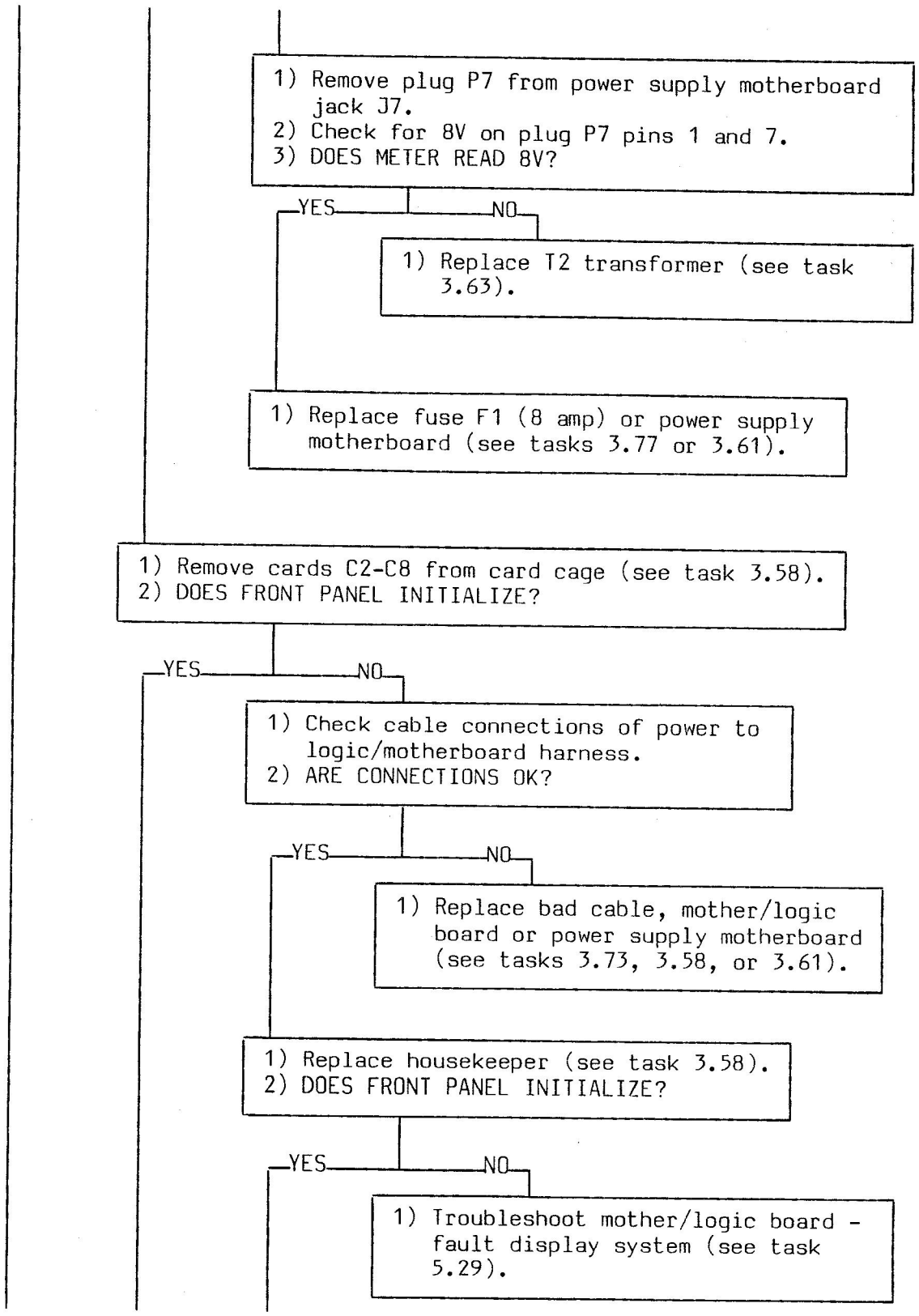

YES
NO
1) Replace power supply motherboard (see task 3.61).
1) Remove spindle logic CPU (see task 3.58).
2) Measure voltage at pin 41 (43) on mother/logic board jack XA6.
3) DOES VOLTAGE MEASURE 10V (60V)?
YES
NO
1) Check cable connections at jack J25 on mother/logic board and P1 on power supply motherboard.
2) ARE CONNECTIONS OK?
YES
NO
1) Replace bad power to mother/logic board harness, mother/logic board or power supply motherboard (see task 3.73, 3.58 or 3.61).
1) Replace mother/logic board (see task 3.58).
1) Replace spindle computer board (see task 3.58).

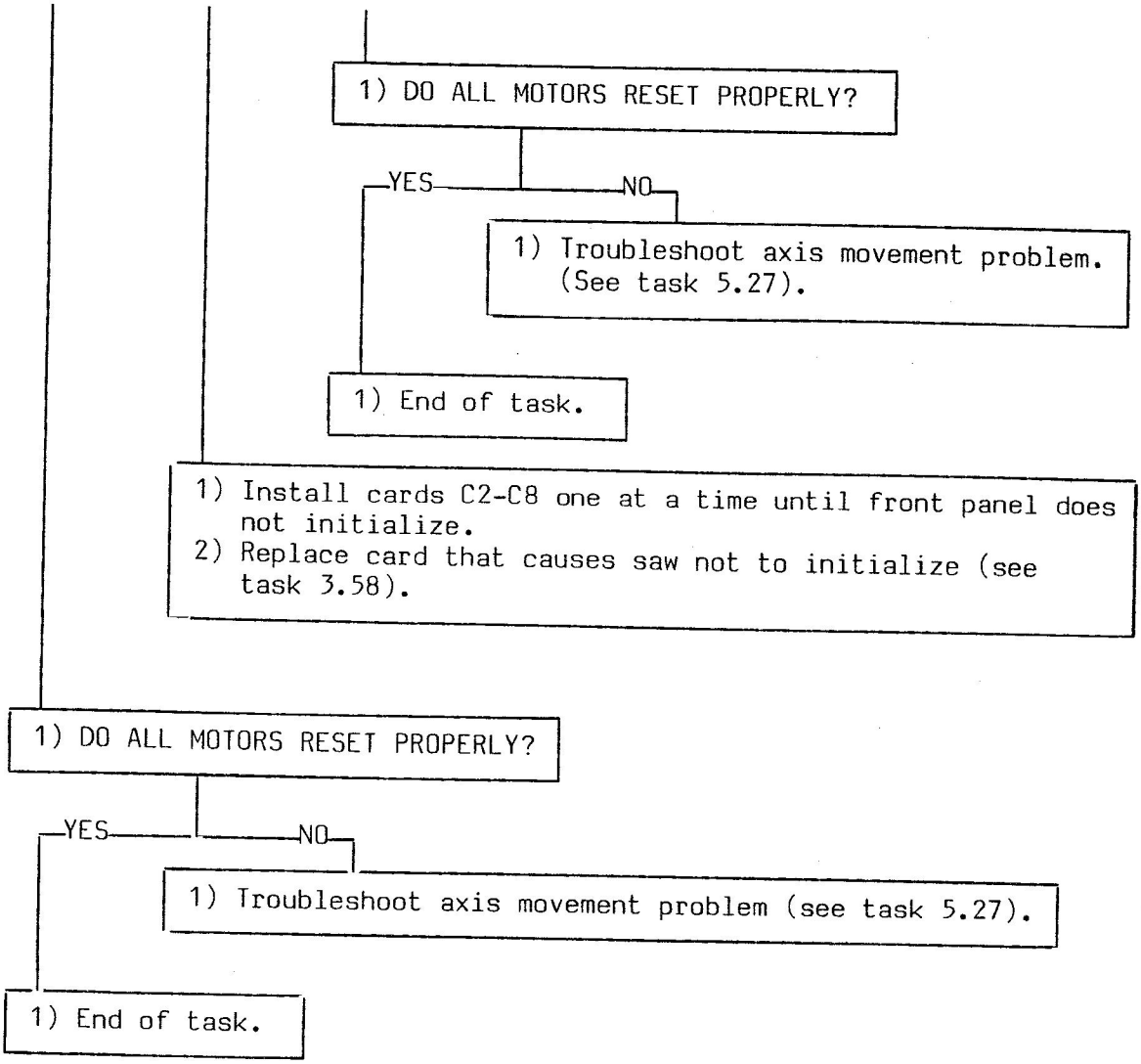
6.25 TROUBLESHOOT INITIAL POWER ON SEQUENCE

NOTE: IF AT ANY TIME A FAULT CODE MESSAGE IS DISPLAYED ON SAW PROGRAM PANEL, PERFORM THE FOLLOW-ON ANALYSIS LISTED FOR THAT FAULT CODE.




1) Are any fans working?
YES
NO
1) Problem unknown. Consult factory.
1) Replace bad fan.
1) DO FRONT PANEL INDICATOR LIGHTS INITIALIZE BY FLICKERING?
YES
NO
1) Check fuse F3 and F4 of 10V input power.
2) ARE BOTH FUSES OK?
YES
NO
1) Replace both 2 amp fuses (see task 3.77).
1) Check for +8V at TP4 and -8V at TP6 on power supply motherboard.
2) DOES METER READ CORRECT VOLTAGES?
YES
NO
1) Check cable connection on power supply motherboard jack J7.
2) IS CONNECTION OK?
YES
NO
1) Replace bad cable or power supply motherboard (see tasks 3.71 and 3.61).

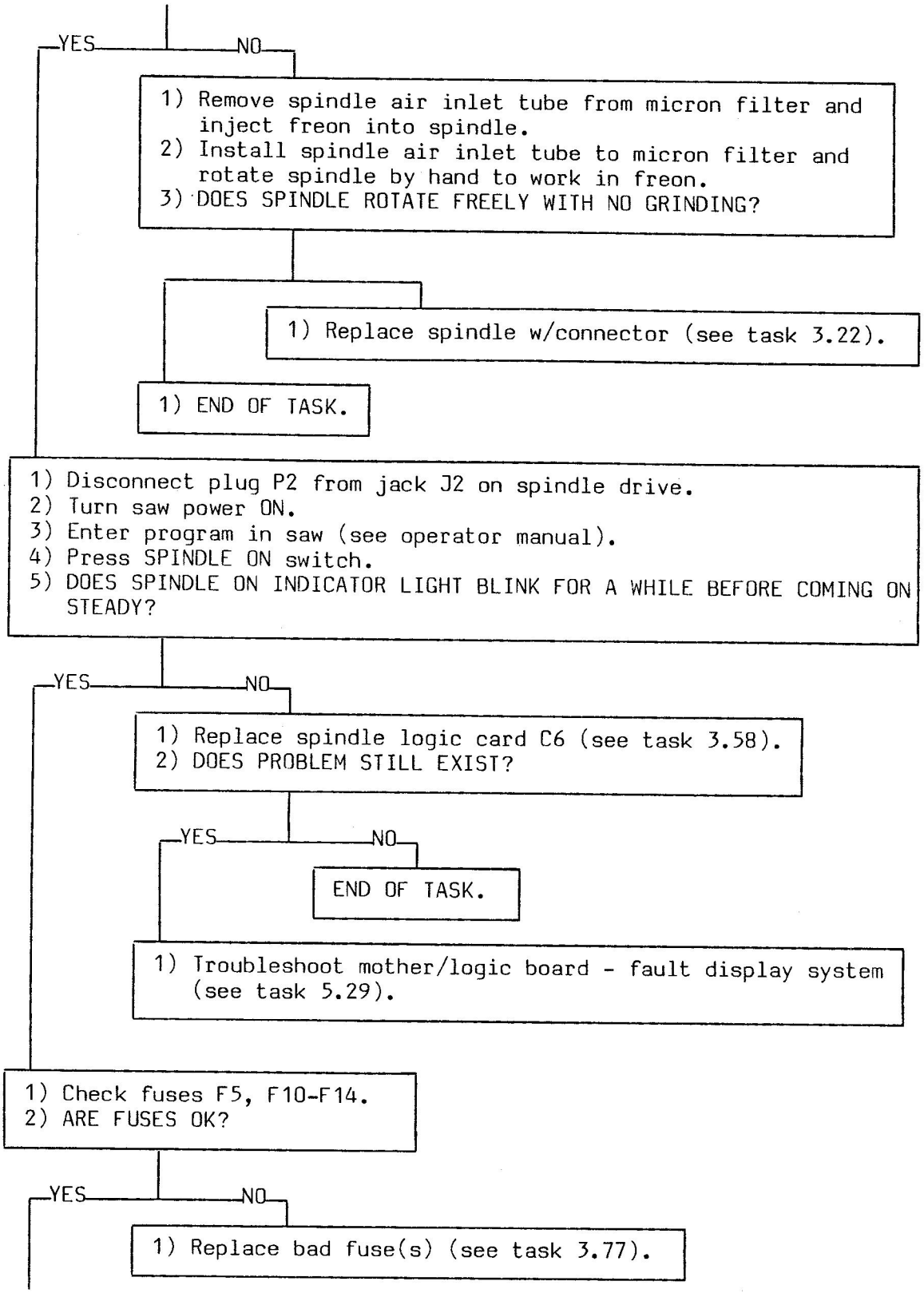

1) Remove plug P7 from power supply motherboard jack J7.
2) Check for 8V on plug P7 pins 1 and 7.
3) DOES METER READ 8V?
YES
NO
1) Replace T2 transformer (see task 3.63).
1) Replace fuse F1 (8 amp) or power supply motherboard (see tasks 3.77 or 3.61).
1) Remove cards C2-C8 from card cage (see task 3.58).
2) DOES FRONT PANEL INITIALIZE?
YES
NO
1) Check cable connections of power to logic/motherboard harness.
2) ARE CONNECTIONS OK?
YES
NO
1) Replace bad cable, mother/logic board or power supply motherboard (see tasks 3.73, 3.58, or 3.61).
1) Replace housekeeper (see task 3.58).
2) DOES FRONT PANEL INITIALIZE?
YES
NO
1) Troubleshoot mother/logic board - fault display system (see task 5.29).

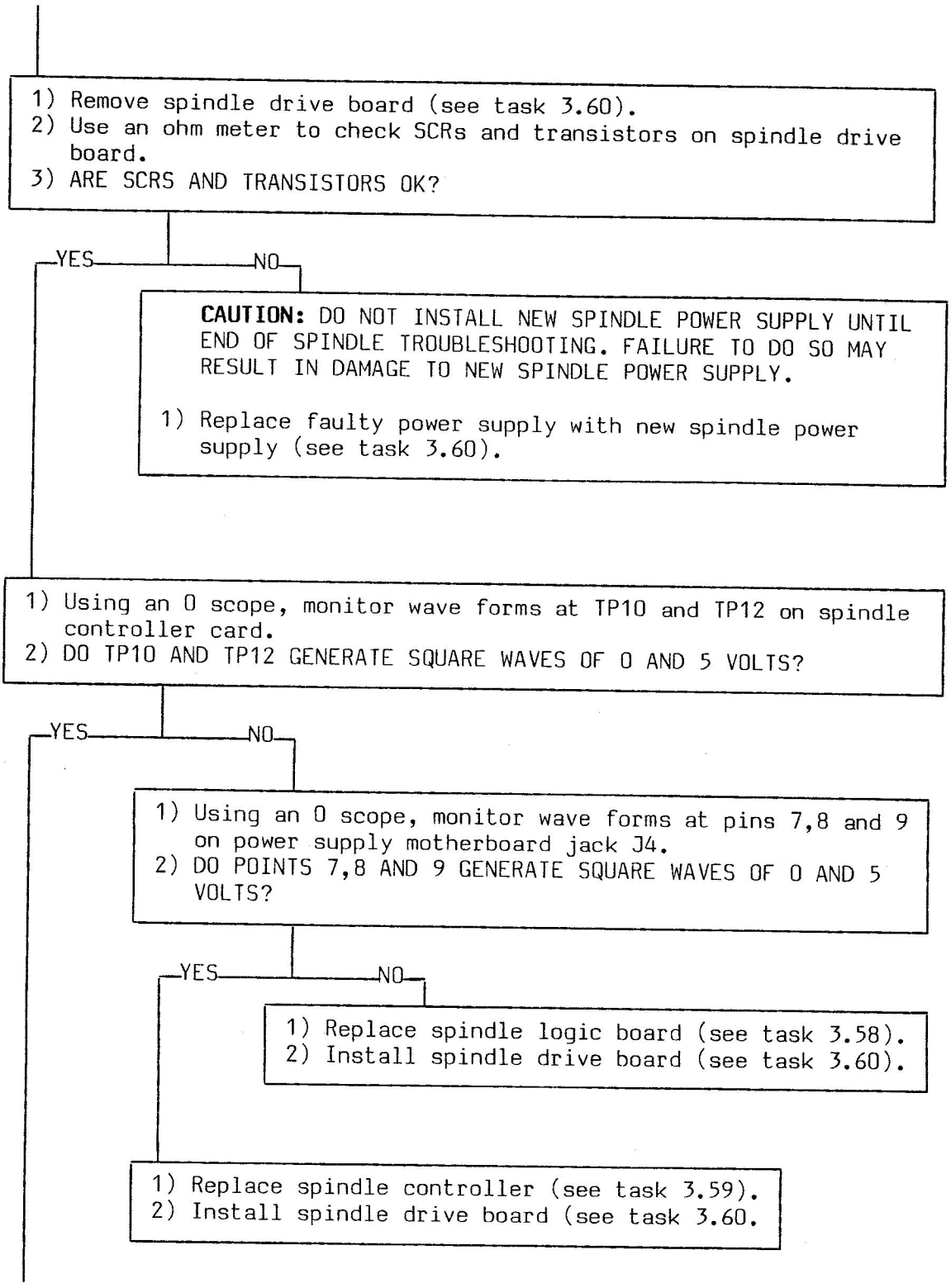


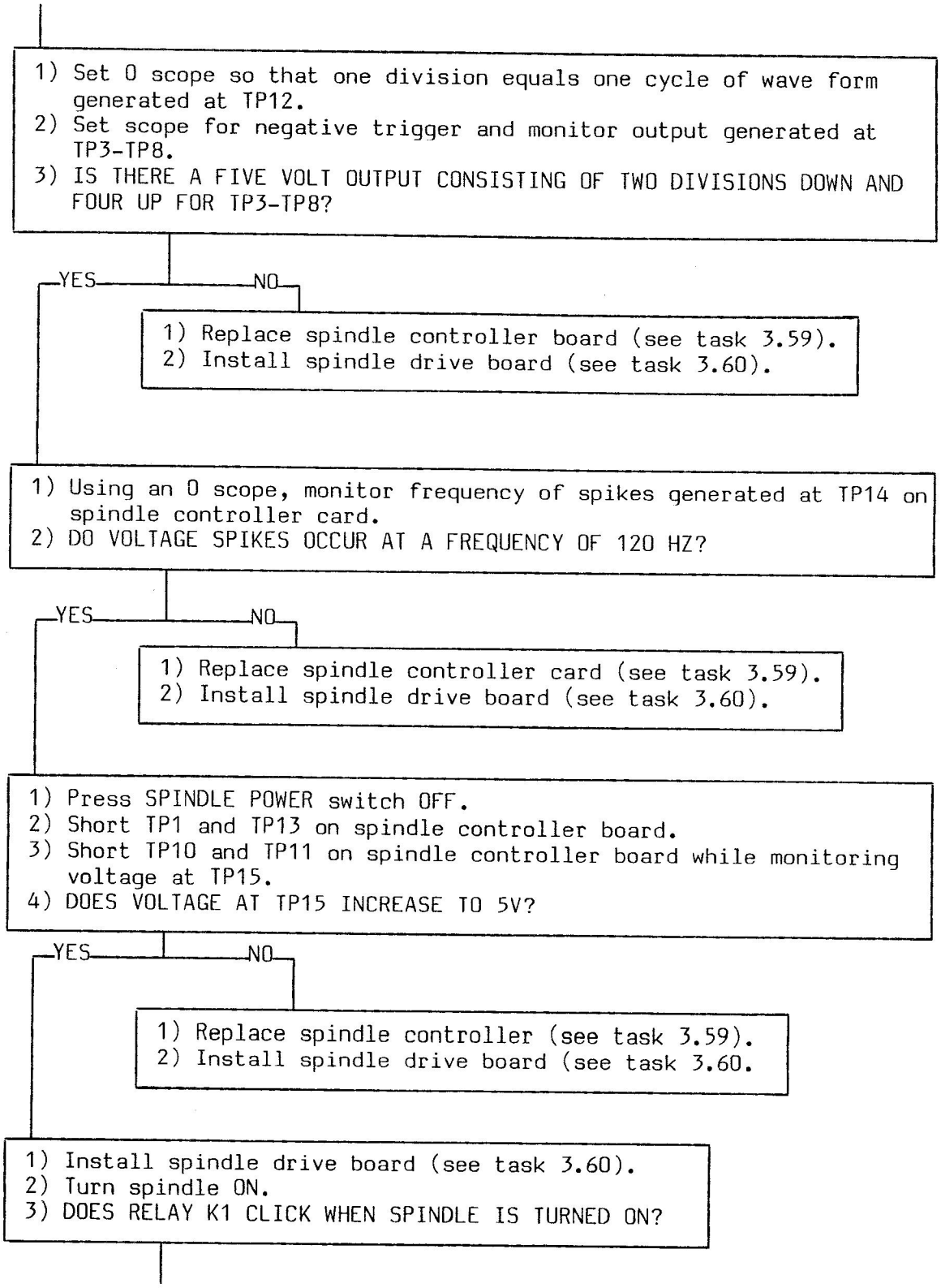
6.26 TROUBLESHOOT SPINDLE

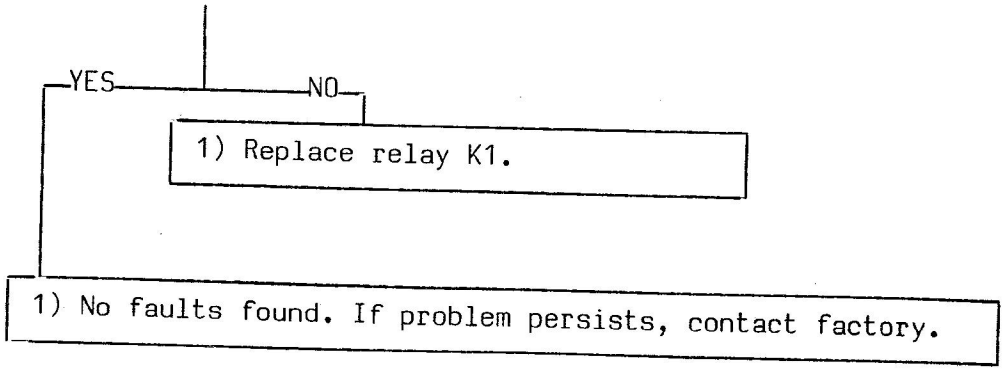
NOTE: IF AT ANY TIME A FAULT CODE MESSAGE IS DISPLAYED ON SAW PROGRAM PANEL, PERFORM THE FOLLOW-ON ANALYSIS LISTED FOR THAT FAULT CODE.

1) With power to saw turned OFF and air pressure to spindle on, rotate spindle by hand.
2) DOES SPINDLE ROTATE FREELY WITH NO GRINDING?

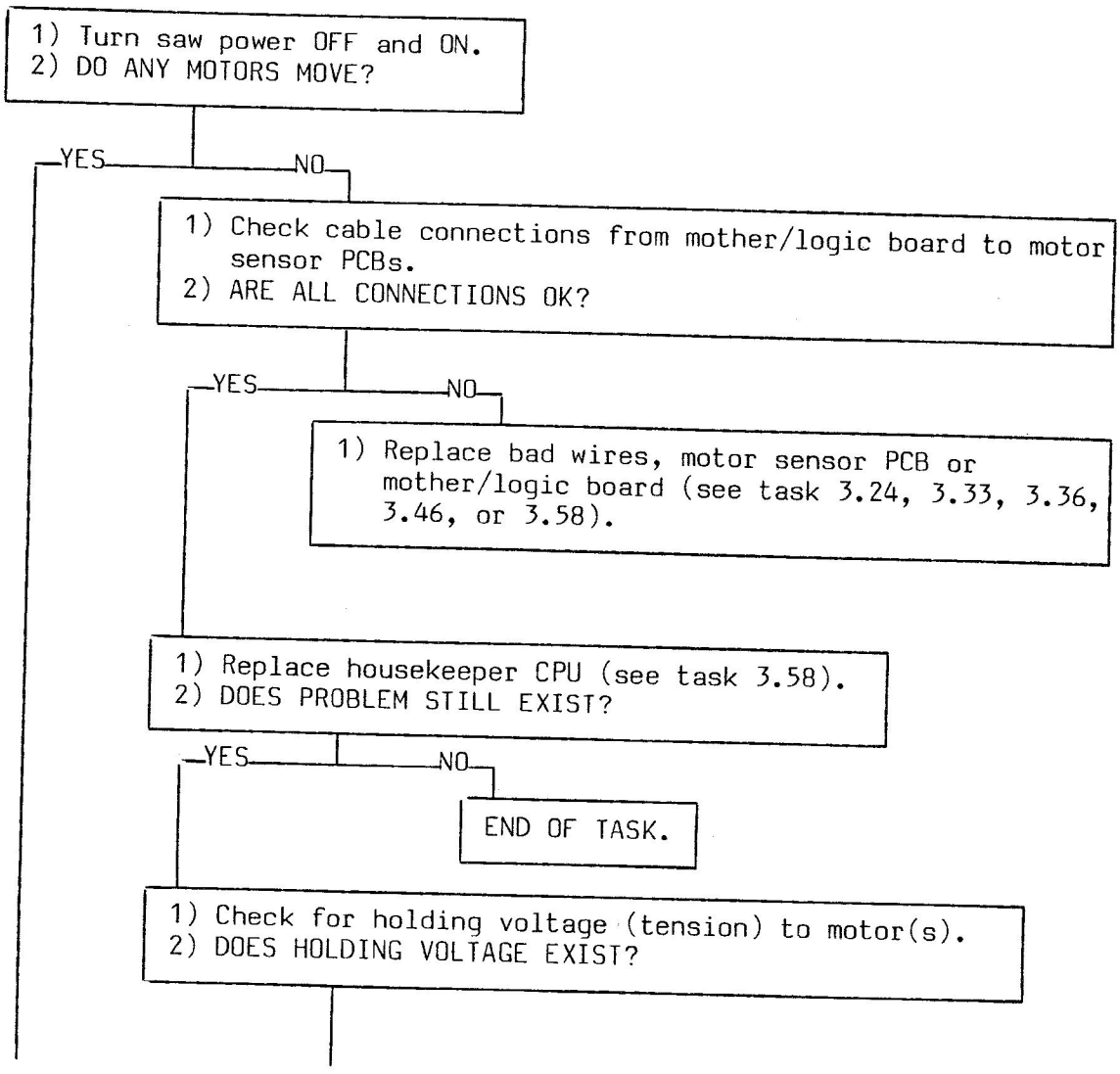

YES
NO
1) Remove spindle air inlet tube from micron filter and inject freon into spindle.
2) Install spindle air inlet tube to micron filter and rotate spindle by hand to work in freon.
3) DOES SPINDLE ROTATE FREELY WITH NO GRINDING?
1) Replace spindle w/connector (see task 3.22).
1) END OF TASK.
1) Disconnect plug P2 from jack J2 on spindle drive.
2) Turn saw power ON.
3) Enter program in saw (see operator manual).
4) Press SPINDLE ON switch.
5) DOES SPINDLE ON INDICATOR LIGHT BLINK FOR A WHILE BEFORE COMING ON STEADY?
YES
NO
1) Replace spindle logic card C6 (see task 3.58).
2) DOES PROBLEM STILL EXIST?
YES
NO
END OF TASK.
1) Troubleshoot mother/logic board - fault display system (see task 5.29).
1) Check fuses F5, F10-F14.
2) ARE FUSES OK?
YES
NO
1) Replace bad fuse(s) (see task 3.77).

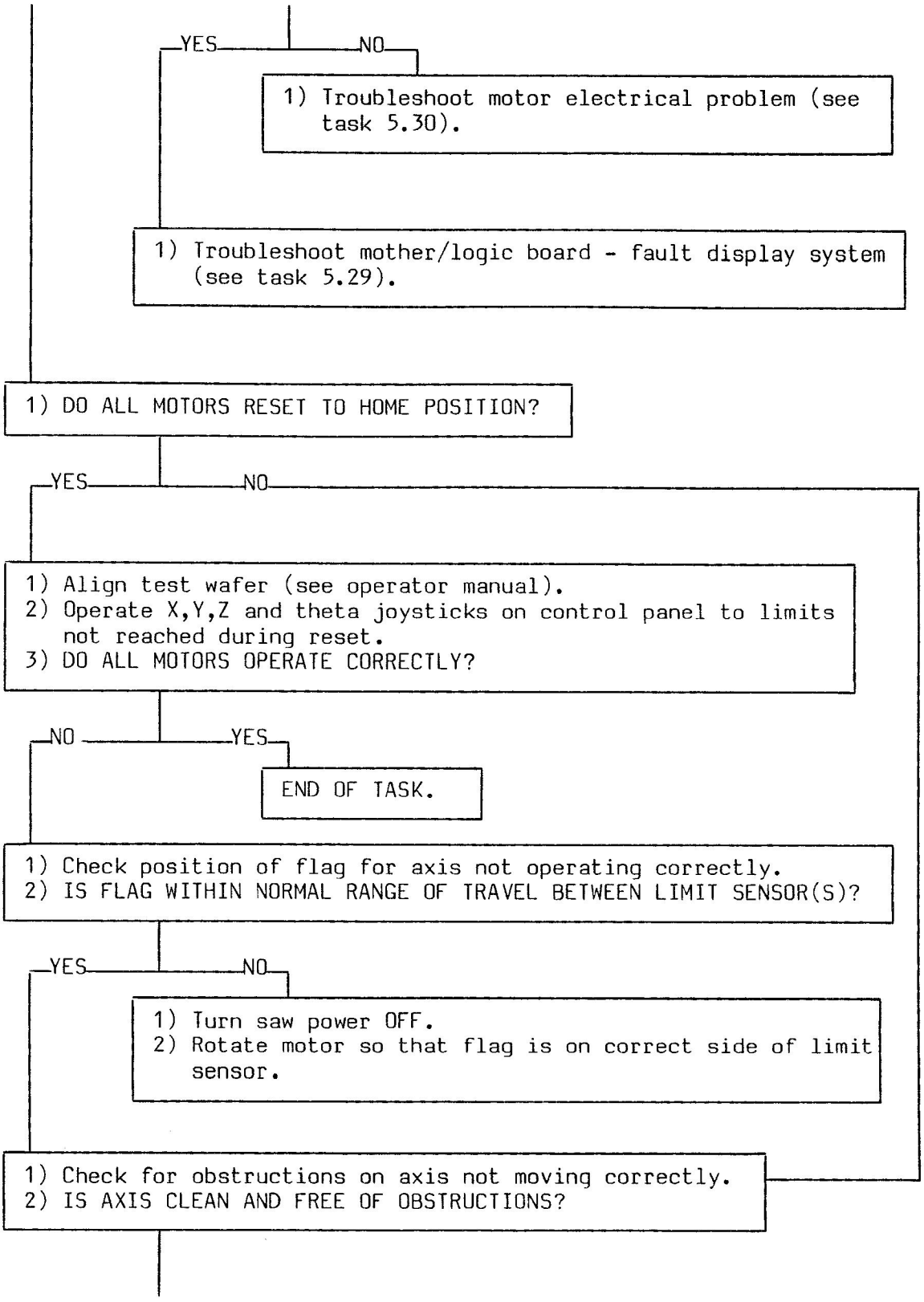

1) Remove spindle drive board (see task 3.60).
2) Use an ohm meter to check SCRs and transistors on spindle drive board.
3) ARE SCRS AND TRANSISTORS OK?
YES
NO
CAUTION: DO NOT INSTALL NEW SPINDLE POWER SUPPLY UNTIL END OF SPINDLE TROUBLESHOOTING. FAILURE TO DO SO MAY RESULT IN DAMAGE TO NEW SPINDLE POWER SUPPLY.
1) Replace faulty power supply with new spindle power supply (see task 3.60).
1) Using an O scope, monitor wave forms at TP10 and TP12 on spindle controller card.
2) DO TP10 AND TP12 GENERATE SQUARE WAVES OF 0 AND 5 VOLTS?
YES
NO
1) Using an O scope, monitor wave forms at pins 7,8 and 9 on power supply motherboard jack J4.
2) DO POINTS 7,8 AND 9 GENERATE SQUARE WAVES OF 0 AND 5 VOLTS?
YES
NO
1) Replace spindle logic board (see task 3.58).
2) Install spindle drive board (see task 3.60).
1) Replace spindle controller (see task 3.59).
2) Install spindle drive board (see task 3.60.

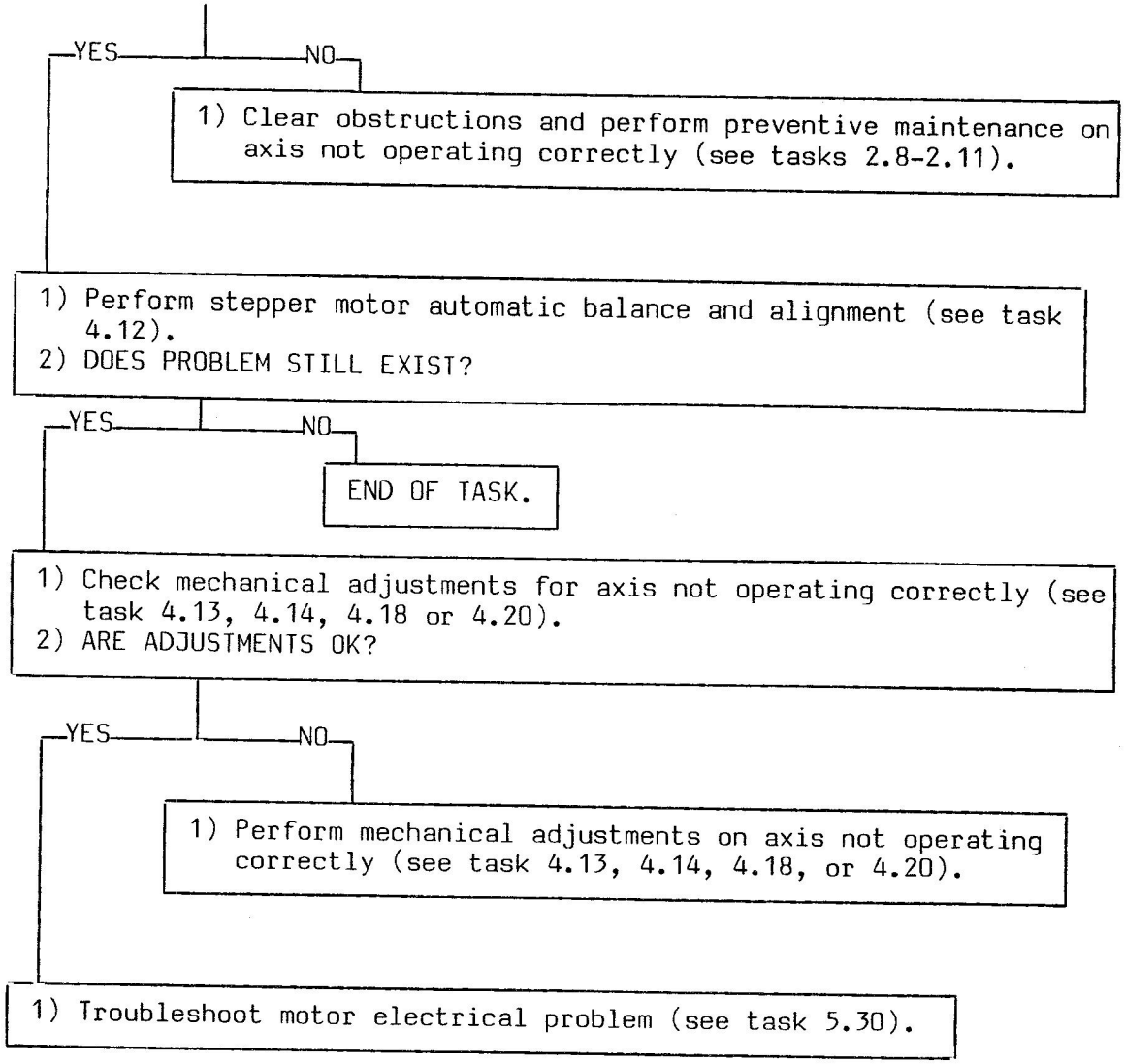

1) Set O scope so that one division equals one cycle of wave form generated at TP12.
2) Set scope for negative trigger and monitor output generated at TP3-TP8.
3) IS THERE A FIVE VOLT OUTPUT CONSISTING OF TWO DIVISIONS DOWN AND FOUR UP FOR TP3-TP8?
YES
NO
1) Replace spindle controller board (see task 3.59).
2) Install spindle drive board (see task 3.60).
1) Using an O scope, monitor frequency of spikes generated at TP14 on spindle controller card.
2) DO VOLTAGE SPIKES OCCUR AT A FREQUENCY OF 120 HZ?
YES
NO
1) Replace spindle controller card (see task 3.59).
2) Install spindle drive board (see task 3.60).
1) Press SPINDLE POWER switch OFF.
2) Short TP1 and TP13 on spindle controller board.
3) Short TP10 and TP11 on spindle controller board while monitoring voltage at TP15.
4) DOES VOLTAGE AT TP15 INCREASE TO 5V?
YES
NO
1) Replace spindle controller (see task 3.59).
2) Install spindle drive board (see task 3.60.
1) Install spindle drive board (see task 3.60).
2) Turn spindle ON.
3) DOES RELAY K1 CLICK WHEN SPINDLE IS TURNED ON?



6.27 TROUBLESHOOT AXIS MOVEMENT PROBLEM

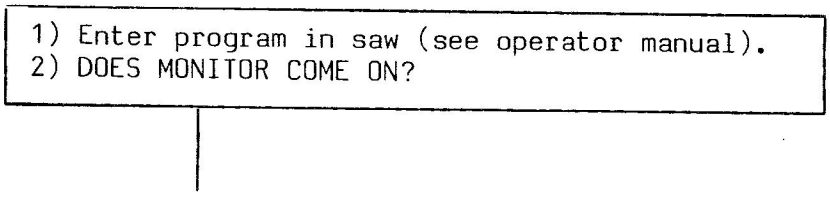


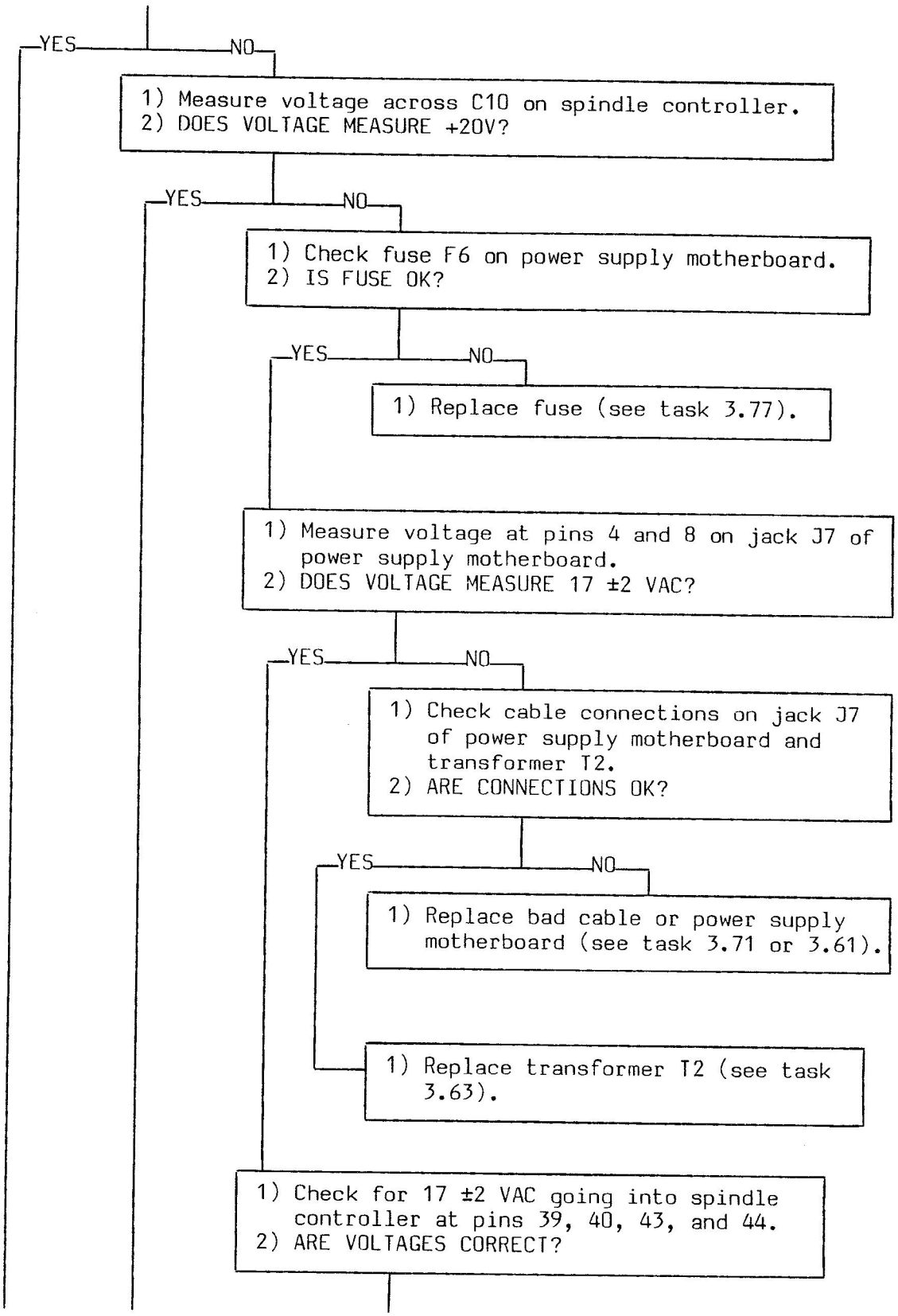

YES
NO
1) Troubleshoot motor electrical problem (see task 5.30).
1) Troubleshoot mother/logic board - fault display system (see task 5.29).
1) DO ALL MOTORS RESET TO HOME POSITION?
YES
NO
1) Align test wafer (see operator manual).
2) Operate X,Y,Z and theta joysticks on control panel to limits not reached during reset.
3) DO ALL MOTORS OPERATE CORRECTLY?
NO
YES
END OF TASK.
1) Check position of flag for axis not operating correctly.
2) IS FLAG WITHIN NORMAL RANGE OF TRAVEL BETWEEN LIMIT SENSOR(S)?
YES
NO
1) Turn saw power OFF.
2) Rotate motor so that flag is on correct side of limit sensor.
1) Check for obstructions on axis not moving correctly.
2) IS AXIS CLEAN AND FREE OF OBSTRUCTIONS?

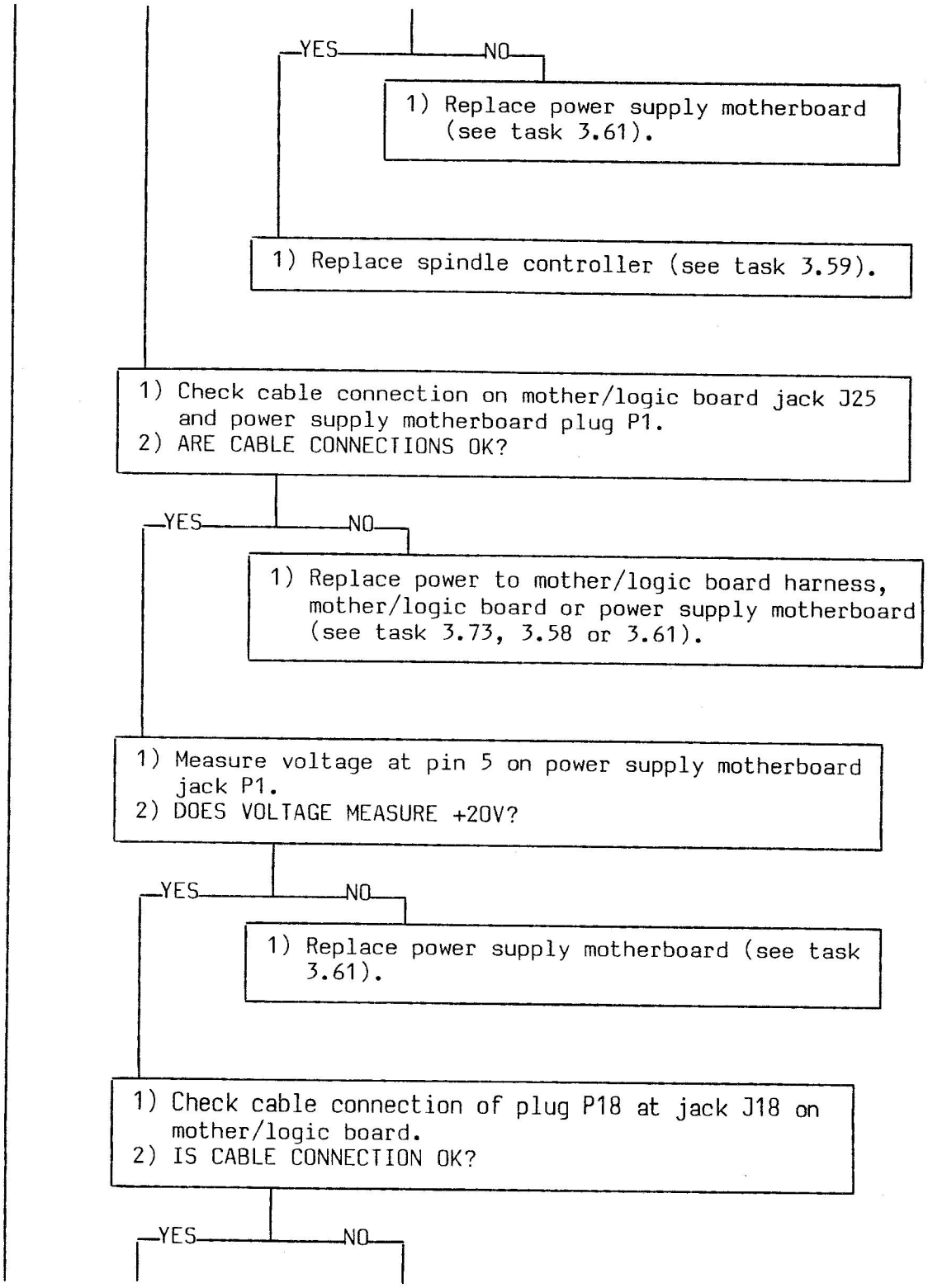


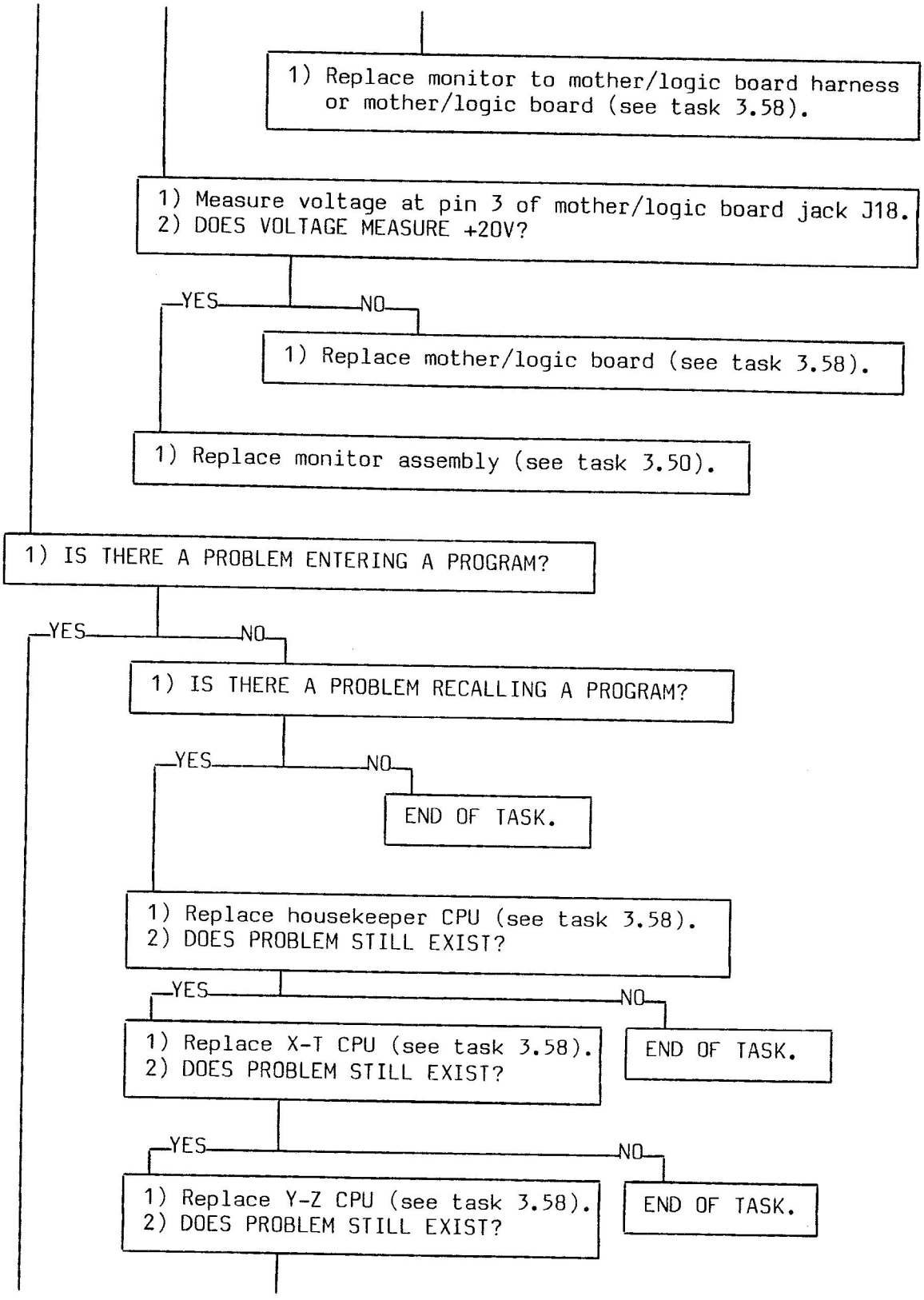
6.28 TROUBLESHOOT SAW PROGRAMMING PROBLEM

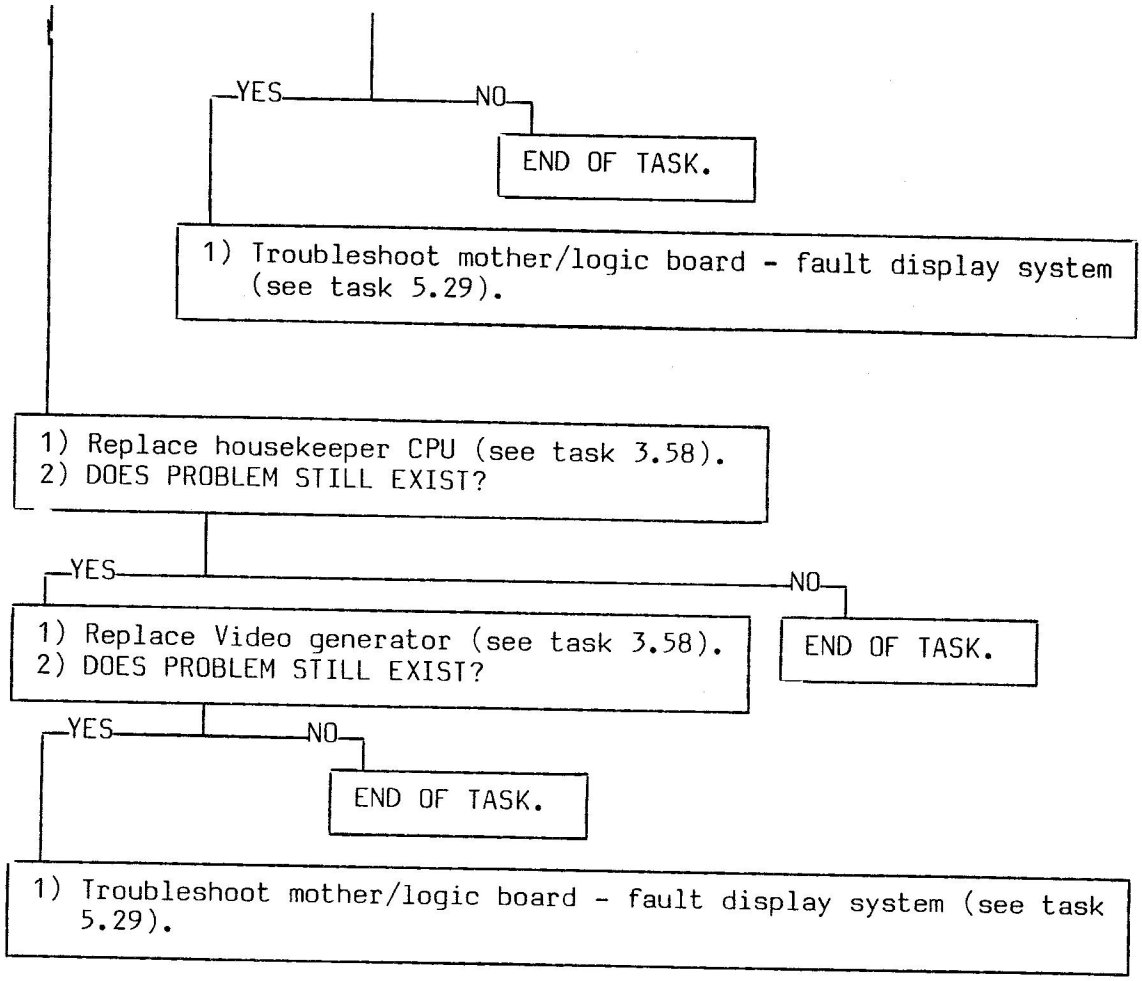
NOTE: IF AT ANY TIME A FAULT CODE MESSAGE IS DISPLAYED ON SAW PROGRAM PANEL, PERFORM THE FOLLOW-ON ANALYSIS LISTED FOR THAT FAULT CODE.



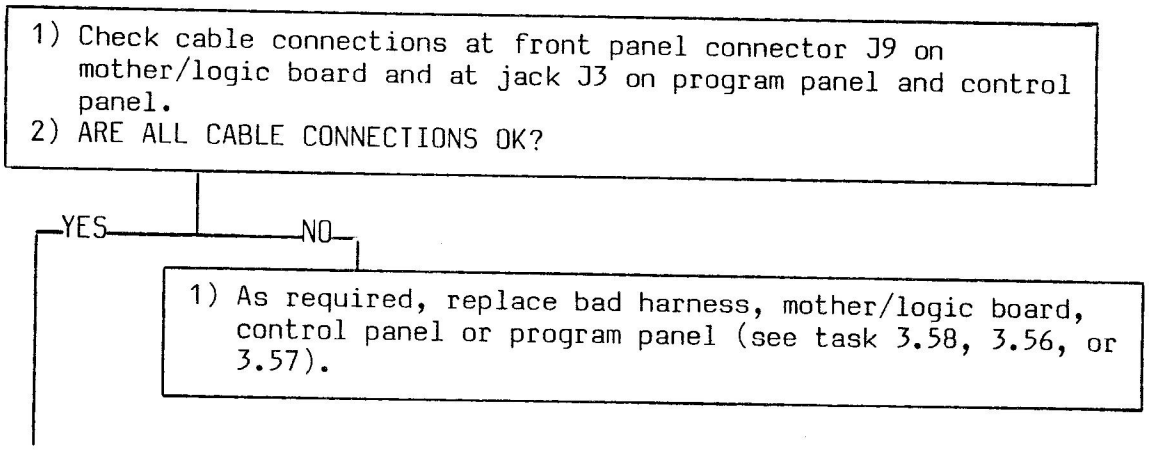

YES
NO
1) Measure voltage across C10 on spindle controller.
2) DOES VOLTAGE MEASURE +20V?
YES
NO
1) Check fuse F6 on power supply motherboard.
2) IS FUSE OK?
YES
NO
1) Replace fuse (see task 3.77).
1) Measure voltage at pins 4 and 8 on jack J7 of power supply motherboard.
2) DOES VOLTAGE MEASURE 17 ±2 VAC?
YES
NO
1) Check cable connections on jack J7 of power supply motherboard and transformer T2.
2) ARE CONNECTIONS OK?
YES
NO
1) Replace bad cable or power supply motherboard (see task 3.71 or 3.61).
1) Replace transformer T2 (see task 3.63).
1) Check for 17 ±2 VAC going into spindle controller at pins 39, 40, 43, and 44.
2) ARE VOLTAGES CORRECT?

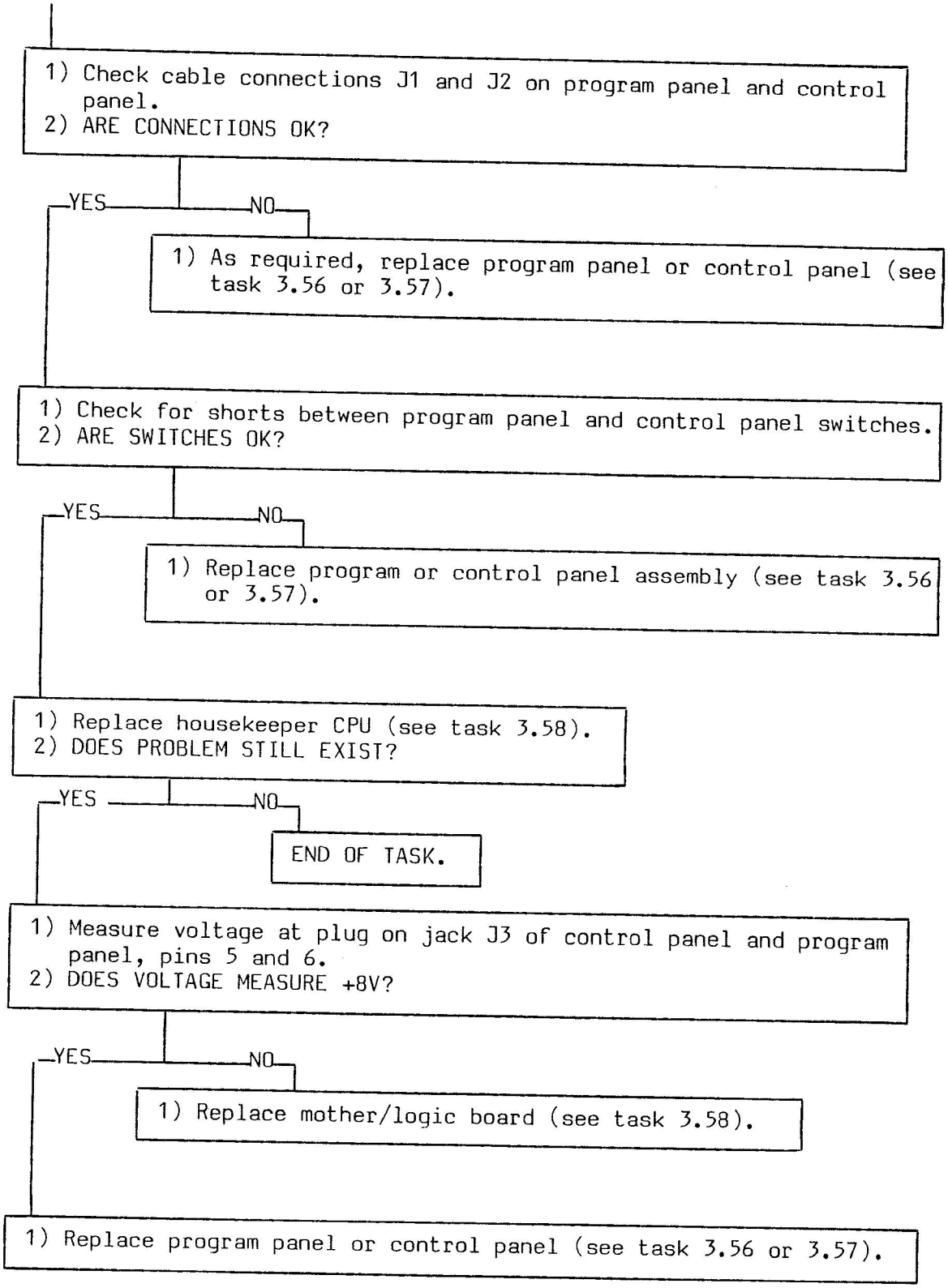

YES
NO
1) Replace power supply motherboard (see task 3.61).
1) Replace spindle controller (see task 3.59).
1) Check cable connection on mother/logic board jack J25 and power supply motherboard plug P1.
2) ARE CABLE CONNECTIONS OK?
YES
NO
1) Replace power to mother/logic board harness, mother/logic board or power supply motherboard (see task 3.73, 3.58 or 3.61).
1) Measure voltage at pin 5 on power supply motherboard jack P1.
2) DOES VOLTAGE MEASURE +20V?
YES
NO
1) Replace power supply motherboard (see task 3.61).
1) Check cable connection of plug P18 at jack J18 on mother/logic board.
2) IS CABLE CONNECTION OK?
YES
NO


1) Replace monitor to mother/logic board harness or mother/logic board (see task 3.58).
1) Measure voltage at pin 3 of mother/logic board jack J18.
2) DOES VOLTAGE MEASURE +20V?
YES
NO
1) Replace mother/logic board (see task 3.58).
1) Replace monitor assembly (see task 3.50).
1) IS THERE A PROBLEM ENTERING A PROGRAM?
YES
NO
1) IS THERE A PROBLEM RECALLING A PROGRAM?
YES
NO
END OF TASK.
1) Replace housekeeper CPU (see task 3.58).
2) DOES PROBLEM STILL EXIST?
YES
NO
1) Replace X-T CPU (see task 3.58).
2) DOES PROBLEM STILL EXIST?
END OF TASK.
YES
NO
1) Replace Y-Z CPU (see task 3.58).
2) DOES PROBLEM STILL EXIST?
END OF TASK.

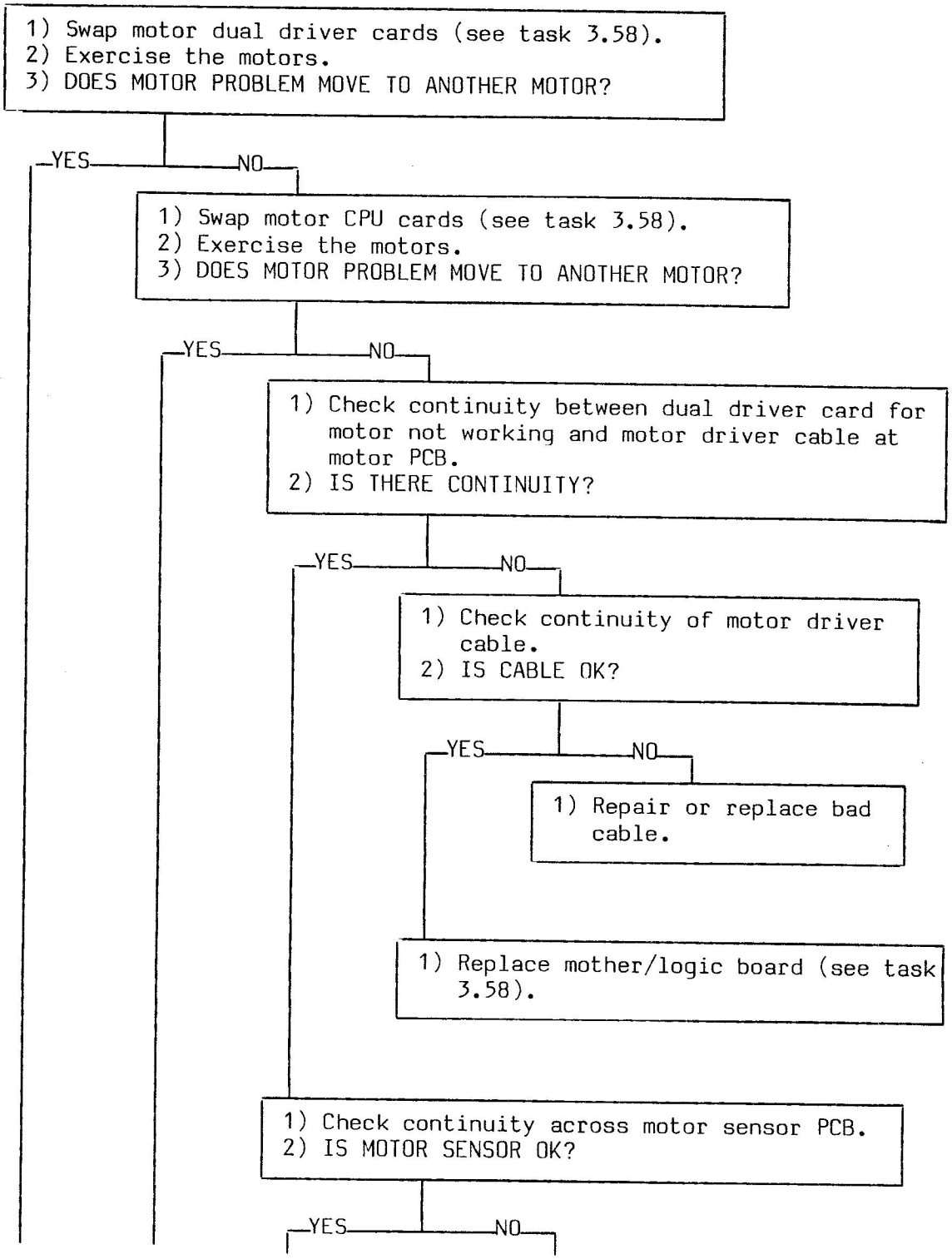


6.29 TROUBLESHOOT MOTHER/LOGIC BOARD - FAULT DISPLAY SYSTEM




1) Check cable connections J1 and J2 on program panel and control panel.
2) ARE CONNECTIONS OK?
YES
NO
1) As required, replace program panel or control panel (see task 3.56 or 3.57).
1) Check for shorts between program panel and control panel switches.
2) ARE SWITCHES OK?
YES
NO
1) Replace program or control panel assembly (see task 3.56 or 3.57).
1) Replace housekeeper CPU (see task 3.58).
2) DOES PROBLEM STILL EXIST?
YES
NO
END OF TASK.
1) Measure voltage at plug on jack J3 of control panel and program panel, pins 5 and 6.
2) DOES VOLTAGE MEASURE +8V?
YES
NO
1) Replace mother/logic board (see task 3.58).
1) Replace program panel or control panel (see task 3.56 or 3.57).

6.30 TROUBLESHOOT MOTOR ELECTRICAL PROBLEM



1) Replace bad motor sensor PCB (see task 3.48).

1) Measure motor cable between the following wires for the following readings:

red	to	red/white	<10 ohms
green	to	green white	<10 ohms
red	to	green	open

2) DOES MOTOR SHOW CORRECT READINGS?

YES — NO

1) Replace motor (see task 3.47 or 3.41).

1) Replace housekeeper (see task 3.58).

1) Replace faulty motor CPU (see task 3.58).

1) Replace faulty dual driver PCB (see task 3.58).

6.31 TROUBLESHOOT LIMIT SENSOR PROBLEM

1) Check cable connections from limit sensor PCB to logic/motherboard.
2) ARE CONNECTIONS OK?

YES — NO

1) Replace bad cable, limit sensor PCB or mother/logic board, as required (see task 3.24, 3.33, 3.36, 3.46, or 3.58).

1) Set volt meter to read 5 VDC.
2) Check sensor output at the following points while blocking and unblocking optical sensor:

   GND (all sensors) - TP1
   X right sensor - TP3
   X left sensor - TP5
   Y forward sensor - TP5
   Y rear sensor - TP3
   Theta CW sensor - TP3
   Theta CCW sensor - TP5
   Z down sensor - TP3

3) DOES OUTPUT CHANGE DIGITAL STATES FROM HI TO LOW WHEN SENSOR IS BLOCKED?

YES

NO

1) IS 5V POWER PRESENT ON LIMIT SENSOR PCB?

YES

NO

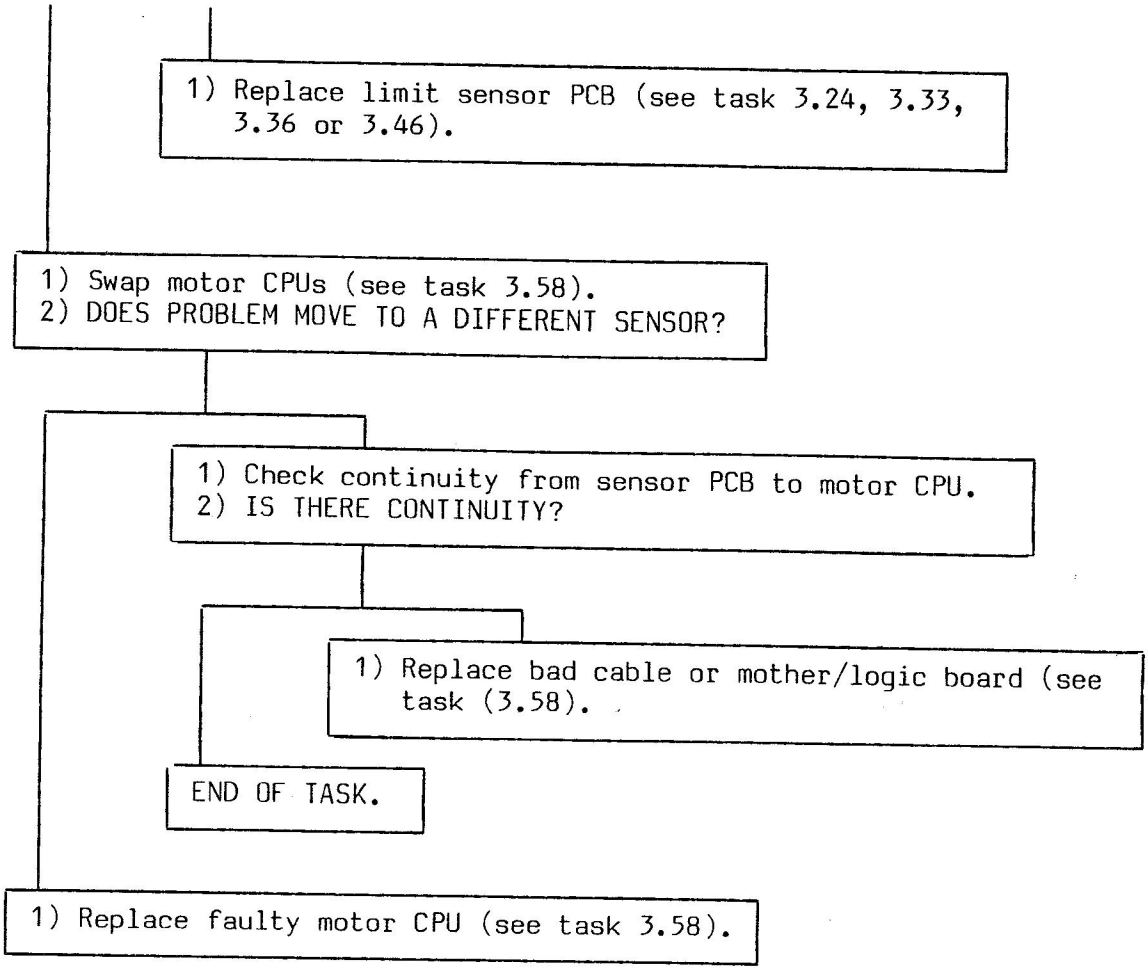
1) Check 5V line from mother/logic board to limit sensor PCB.
2) IS 5V LINE OK?

YES

NO

1) Replace bad cable.

1) Replace mother/logic board (see task 3.58).


1) Replace limit sensor PCB (see task 3.24, 3.33, 3.36 or 3.46).
1) Swap motor CPUs (see task 3.58).
2) DOES PROBLEM MOVE TO A DIFFERENT SENSOR?
1) Check continuity from sensor PCB to motor CPU.
2) IS THERE CONTINUITY?
1) Replace bad cable or mother/logic board (see task (3.58).
END OF TASK.
1) Replace faulty motor CPU (see task 3.58).